TWIN DISC
INCORPORATED

Service Manual

Marine Power Take-off

Document Number: 1020075

NOTICE

Twin Disc, Incorporated makes no warranty or guaranty of any kind, expressed, implied or otherwise, with regard to the information contained within this manual. Twin Disc, Incorporated has developed this manual through research and testing of the information contained therein. Twin Disc, Incorporated assumes no responsibility for any errors that may appear in this manual and shall not be liable under any circumstances for incidental, consequential or punitive damages in connection with, or arising out of, the use of this manual. The information contained within this manual is subject to change without notice.

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March, 2001

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LIMITED TWIN DISC GENERAL WARRANTY, LIMITATIONS OF REMEDIES AND LIMITATION OF OTHER WARRANTIES

A. Twin Disc, Incorporated warrants all assembled products and parts (except component products or parts on which written warranties are issued by the respective manufacturers thereof and are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship. For products and parts other than Rockford power take-offs, such warranty shall extend *for a period of twenty-four (24) months from the date of original shipment by Twin Disc, Incorporated to theoriginal customer, but not to exceed twelve (12) months of service or two thousand (2,000) hours of service, whichever occurs first. For Rockford power take-offs products and parts, such warranty shall extend for a period of fifteen (15) months from the date of original shipment by Twin Disc, Incorporated to the original customer, but not to exceed twelve (12) months of service or one thousand five hundred (1,500) hours of service, whichever occurs first.* **This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability and fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated.**
The original customer does not rely upon any tests or inspections by Twin Disc, Incorporated or on Twin Disc, Incorporated's application engineering.

B. **In consideration of the Limited Twin Disc General Warranty (hereafter called warranty) and price Twin Disc, Incorporated charges (which reflects Twin Disc, Incorporated's limited liability), the exclusive remedy provided by Twin Disc, Incorporated whether arising out of warranty within the applicable warranty period as specified, or otherwise (including tort liability), shall at the sole option of Twin Disc, Incorporated be either the repair or replacement of any Twin Disc, Incorporated part or product found by Twin Disc, Incorporated to be defective (or equivalent credit). Under no circumstances, including a failure of the exclusive remedy, shall Twin Disc, Incorporated be liable for economic loss, consequential, punitive or incidental damages.** The above warranty and remedy are subject to the following terms and conditions:

1. Complete parts or products upon request must be returned transportation prepaid and also the claims submitted to Twin Disc, Incorporated within sixty (60) days after completion of the in-warranty repair.
2. The warranty is void if, in the opinion of Twin Disc, Incorporated, the failure of the part or product resulted from abuse, neglect, improper maintenance or accident.
3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.
4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.
5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.
6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or are Twin Disc authorized replacement parts, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or property, including without limitation, the original customer's and subsequent purchaser's employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

D. Only a Twin Disc, Incorporated authorized factory representative shall have authority to assume any cost or expense in the service, repair or replacement of any part or product within the warranty period, except when such cost or expense is authorized in advance in writing by Twin Disc, Incorporated.

E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no-charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

*Note The Above constitutes the basic Twin Disc, Incorporated General Limited Warranty and may be supplemented by additional published warranty terms dependent upon the product involved. Supplementary warranty terms are available upon request.

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Introduction

General Information

This publication provides the information necessary for the operation and maintenance of the Twin Disc, Incorporated equipment specified on the cover of this manual. Specific engineering details and performance characteristics can be obtained from the Product Service Department of Twin Disc, Incorporated, Racine, Wisconsin, USA.

Operation and maintenance personnel responsible for this equipment should have this manual at their disposal and be familiar with its contents. Applying the information in the manual will result in consistent performance from the unit and help reduce downtime.

Special Tools

Engineering drawings are included for the fabrication of special tools that should be used during disassembly and assembly of a unit. Repair of this equipment should not be attempted without special tools. Twin Disc does not manufacture these tools for general use.

Replacement Parts

Parts Lists

Engineering assembly drawings are provided in appropriate sections of this manual to facilitate ordering spare or replacement parts. Current bill of materials are available from the nearest Authorized Twin Disc Distributor.

Ordering Parts

⚠ WARNING

All replacement parts or products (including hoses and fittings) must be of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Use of any other parts or products will void the warranty and may result in malfunction or accident, causing injury to personnel and/or serious damage to the equipment.

Renewal parts and service parts kits may be obtained from any authorized Twin Disc distributor or service dealer.

Parts Shipment

Furnish the complete shipping information and postal address. All parts shipments made from the factory will be FOB factory location, USA. State specifically whether the parts are to be shipped by freight, express, etc. If shipping instructions are not specified, the equipment will be shipped the best way, considering time and expense. Twin Disc, Incorporated will not be responsible for any charges incurred by this procedure.

Twin Disc, Incorporated having stipulated the bill of material number on the unit's nameplate absolves itself of any responsibility resulting from any external, internal or installation changes made in the field without the express written approval of Twin Disc. All returned parts, new or old, emanating from any of the above stated changes will *not* be accepted for credit. Furthermore, any equipment which has been subjected to such changes will *not* be covered by a Twin Disc warranty.

Preventative Maintenance/Troubleshooting

Frequent reference to the information provided in this manual regarding daily operation and limitations of this equipment will assist in obtaining trouble-free operation. Schedules are provided for the recommended maintenance of the equipment and, if observed, minimum repairs (aside from normal wear) will result.

Lifting Bolt Holes

Most Twin Disc products have provisions for attaching lifting bolts. The holes provided are always of adequate size and number to safely lift the Twin Disc product.

⚠ CAUTION

These lifting points must *not* be used to lift the complete power unit. Lifting excessive loads at these points could cause failure at the lift point (or points) and result in damage or personal injury.

⚠ CAUTION

Select lifting eyebolts to obtain maximum thread engagement with bolt shoulder tight against housing. Bolts should be near but should *not* contact bottom of bolt hole.

Safety

General

Safe practices must be employed by all personnel operating and servicing this unit. Twin Disc, Incorporated will not be responsible for personal injury resulting from careless use of hand tools, lifting equipment, power tools, or unaccepted maintenance/operating practices.

Important Safety Notice

Because of the possible danger to person(s) or property from accidents which may result from the use of manufactured products, it is important that correct procedures be followed. Products must be used in accordance with the engineering information specified. Proper installation, maintenance, and operation procedures must be observed. Inspection should be made as necessary to assure safe operations under prevailing conditions. Proper guards and other suitable safety codes should be provided. These devices are neither provided by Twin Disc, Incorporated nor are they the responsibility of Twin Disc, Incorporated.

Sources of Service Information

Each series of manuals issued by Twin Disc, Incorporated is current at the time of printing. When required, changes are made to reflect advancing technology and improvements in state-of-the-art.

Individual product service bulletins are issued to provide the field with immediate notice of new service information.

For the latest service information on Twin Disc products, contact any Twin Disc distributor, or contact the Product Service Department, Twin Disc, Incorporated, Racine, Wisconsin 53405-3698, USA or by e-mail at service@twindisc.com.

Warranty

Equipment for which this manual was written has a limited warranty. For details of the warranty, refer to the warranty statement at the front of this manual.

Description and Specifications

General

The Twin Disc high torque capacity power take-off unit is designed to mount directly to a Twin Disc marine transmission and is available in two output shaft sizes. Size 32-4 is rated at 592 N-m (437 Ft-lbs) of torque, and size 38-4 is rated at 1187 N-m (875 Ft-lbs) of torque. These are available as live or clutchable power take-offs, and are designed for driving SAE J-744 configured hydraulic pumps. Twin Disc assembly drawings provide dimensional information. They are designed to fit various models of marine transmissions as described below. Note that they are not compatible with marine transmissions that were built before the noted beginning serial number without significant modification to the marine transmission.

Explanation of Model to Serial Number Compatibility

These power take-offs are compatible with the model transmissions with serial numbers equal to or greater than those shown in Table 1. Consult the factory for other applicable transmission models.

Table 1. PTO Compatability - Beginning Serial Numbers

Transmission Model	Serial Number
MG516	3AE809
MG5170	3AE796
MG5202DC	3AE798
MG5205DC	Any
MG5301DC	3AE789
MG6650SC	3AE813
MG6848SC	Any

Explanation of Model Number Designation

The power take-off is designed to drive hydraulic pumps meeting SAE J-744 with flange size 127, and shaft size 32-4 or 38-4. Adapter kits are available to drive smaller sized pumps. The following is an explanation of the number designation for pumps meeting the SAE J-744 criteria. The flange size designation is comprised of two numbers such as 127-4. The first number is the approximate pilot diameter in millimeters. The second number is the quantity of bolt holes for attaching the pump. The power take-off is capable of fitting either the two bolt or four bolt designed pumps. The shaft size is also comprised of two numbers such as 32-4. The first number is the approximate major diameter of the shaft in millimeters. The second number is an arbitrary designation for the shaft design. The 4 means a 30 degree involute spline.

Available Adapter Groups

The following adapter groups are available for use with smaller pumps.

Table 2. Available Adapters for Smaller Pumps

PTO Type	Adapter Number	From Size		To Size	
Clutched	XB2403D	127-4 flange	32-4 shaft	101-2 flange	22-4 shaft
Clutched	XB2403E	127-4 flange	32-4 shaft	82-2 flange	16-4 shaft
Live	XB2403F	127-4 flange	32-4 shaft	101-2 flange	22-4 shaft
Live	XB2403G	127-4 flange	32-4 shaft	82-2 flange	16-4 shaft

Description

The “Live” power take-off consists of appropriate adapters to drive a pump in the direction of engine rotation at a speed equal to engine rpm. The pto and attached pump rotate whenever the engine is running.

The “Clutched” power take-off assembly consists of an input adapter, a hydraulically applied, spring released, clutch assembly with a control valve, and a splined output adapter. The power take-off drives a pump in the direction of engine rotation at a speed equal to engine rpm when the pto control valve is in the engaged position. The rotating components are supported by a combination of ball, tapered roller, and needle thrust bearings. Lubrication is provided from the marine transmission fluid. Threaded holes are provided for use with a customer supplied support bracket.

Specifications

The clutched power take-off assembly has a metal tag with the bill of material number stamped, identifying the configuration as built and shipped by Twin Disc. The differences between the various available versions are only in the mounting and engaging arrangements for the model of marine transmission that the power take-off is being used on.

The bill of material of the live power take-off assembly is only identified on the original paperwork, and the differences are in the means to adapt to the applicable transmission model.

Clutch Plate Wear Limits

1. Steel separator plates must be flat within 0.010 inch. Small areas of local heat are acceptable if the plate is within the flatness tolerance.

2. Friction plates should be flat, and the new thickness is 0.107 to 0.115 inch. Any plate that is less than 0.100 inch total thickness should be replaced.

Torque Values for Fasteners

Note: All threads and bearing face to be lubricated with light oil film prior to assembly.

Table 3. U.S. Standard Fine and Coarse Thread Capscrews, Bolts, and Nuts

Thread Diameter	SAE Grade 5		SAE Grade 8	
	lb-ft	Nm	lb-ft	Nm
1/4	6 - 8	8 - 11	10 - 12	14 - 16
5/16	13 - 17	18 - 23	20 - 24	27 - 32
3/8	25 - 29	34 - 39	35 - 41	48 - 55
7/16	37 - 43	51 - 58	55 - 65	75 - 88
1/2	60 - 70	81 - 95	83 - 97	113 - 131
9/16	82 - 98	111 - 132	120 - 140	163 - 190
5/8	120 - 140	163 - 190	165 - 195	224 - 264
3/4	205 - 245	278 - 332	295 - 345	400 - 467
7/8	330 - 390	448 - 528	470 - 550	638 - 745
1	495 - 595	671 - 806	715 - 845	970 - 1145
1 1/8	615 - 745	834 - 1010	1015 - 1185	1377 - 1606
1 1/4	850 - 1000	1163 - 1355	1375 - 1625	1865 - 2203

Table 4. Metric Coarse Thread Capscrews, Bolts, and Nuts

Thread Size	Property Class 8.8		Property Class 10.9		Property Class 12.9	
	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm
M6	6.5 - 7.5	9 - 10	9 - 10	12 - 14	10 - 12	14 - 16
M8	16 - 18	21 - 25	23 - 26	31 - 35	25 - 29	34 - 40
M10	32 - 36	43 - 49	44 - 51	60 - 68	51 - 59	70 - 80
M12	55 - 63	74 - 86	77 - 88	104 - 120	89 - 103	121 - 139
M16	132 - 151	179 - 205	189 - 217	256 - 294	219 - 253	298 - 342
M20	257 - 295	348 - 400	364 - 418	493 - 567	429 - 493	581 - 669
M24	445 - 511	603 - 693	626 - 720	848 - 976	737 - 848	1000 - 1150
M30	714 - 820	987 - 1113	1235 - 1421	1674 - 1926	1475 - 1697	2000 - 2301

Table 5. Tapered Pipe Plugs (with thread lubricant)

NPTF Size (in)	Nm (+ or - 5 %)	lb-ft (+ or - 5 %)	Nm (+ or - 5 %)	lf-ft (+ or - 5 %)
1/16-27	11.5	8.5	7.5	5.5
1/8-27	14	10.5	9	6.5
1/4-18	34	25	21.5	16
3/8-18	36.5	27	23	17
1/2-14	68	50	40.5	30
3/4-14	73	54	46	34
1 -11 1/2	108	80	68	50
1 1/4 - 11 1/2	115	85	75	55
1 1/2 - 11 1/2	115	85	75	55

Table 6. Straight Threaded Tube Fittings, Hose Fittings, and O-ring Plugs

Nominal Thread Diameter	Nm + or - 5 %	lb-ft + or - 5 %	Nominal Thread Diameter	Nm + or - 5 %	lb-ft + or - 5 %
5/16	5	3.5	M10X1.0	26	19
3/8	11.5	8.5	M12X1.5	37	27
7/16	16	12	M14X1.5	47	35
1/2	20	15	M16X1.5	58	43
9/16	24.5	18	M18X1.5	74	55
5/8	24.5	18	M22X1.5	105	77
11/16	34	25	M27X2.0 IN IRON	179	132
3/4	40.5	30	M27X2.0 IN ALUM	85	63
7/8	54	40	M33X2.0	326	240
1 1/16	75	55	M42X2.0	347	256
1 3/16	88	65	M48X2.0	441	325
1 1/4	88	65	-	-	-
1 5/16	108	80	-	-	-
1 3/8	108	80	-	-	-
1 5/8	135	100	-	-	-
1 7/8	162	120	-	-	-
2 1/2	312	230	-	-	-

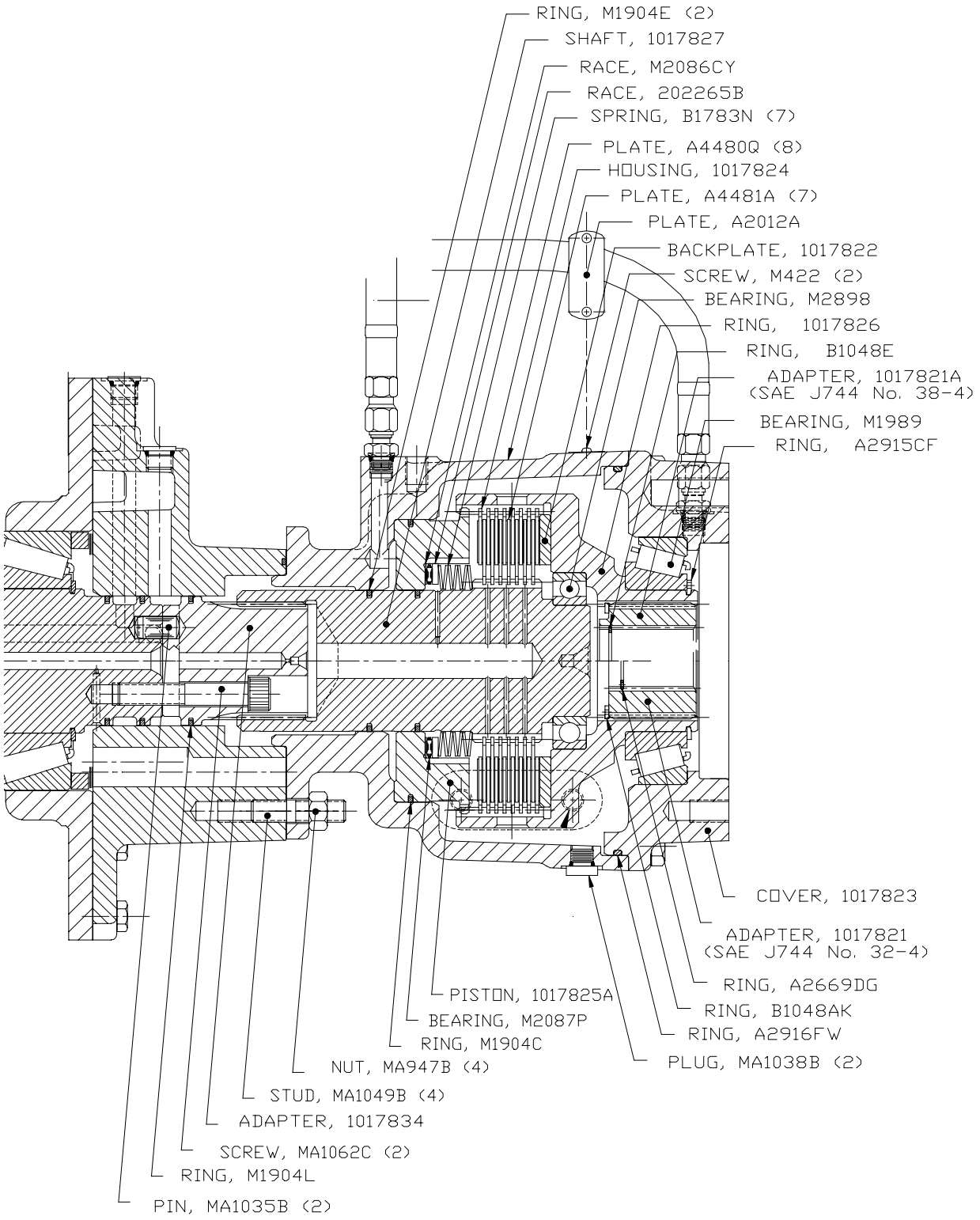


Figure 1. Clutched Power Take-off Parts (for reference only)

Refer to Bill of Materials for actual part number when ordering parts

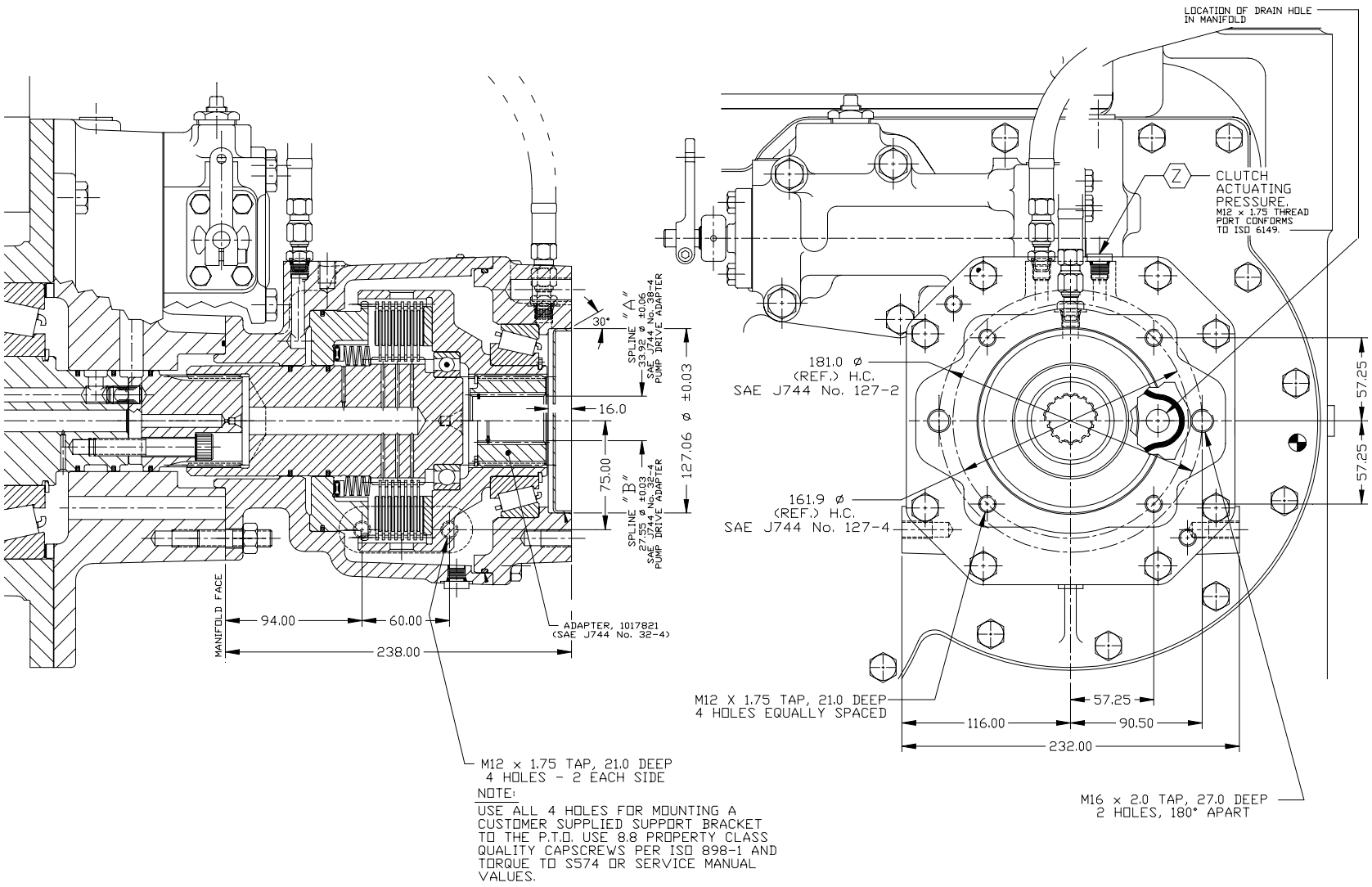
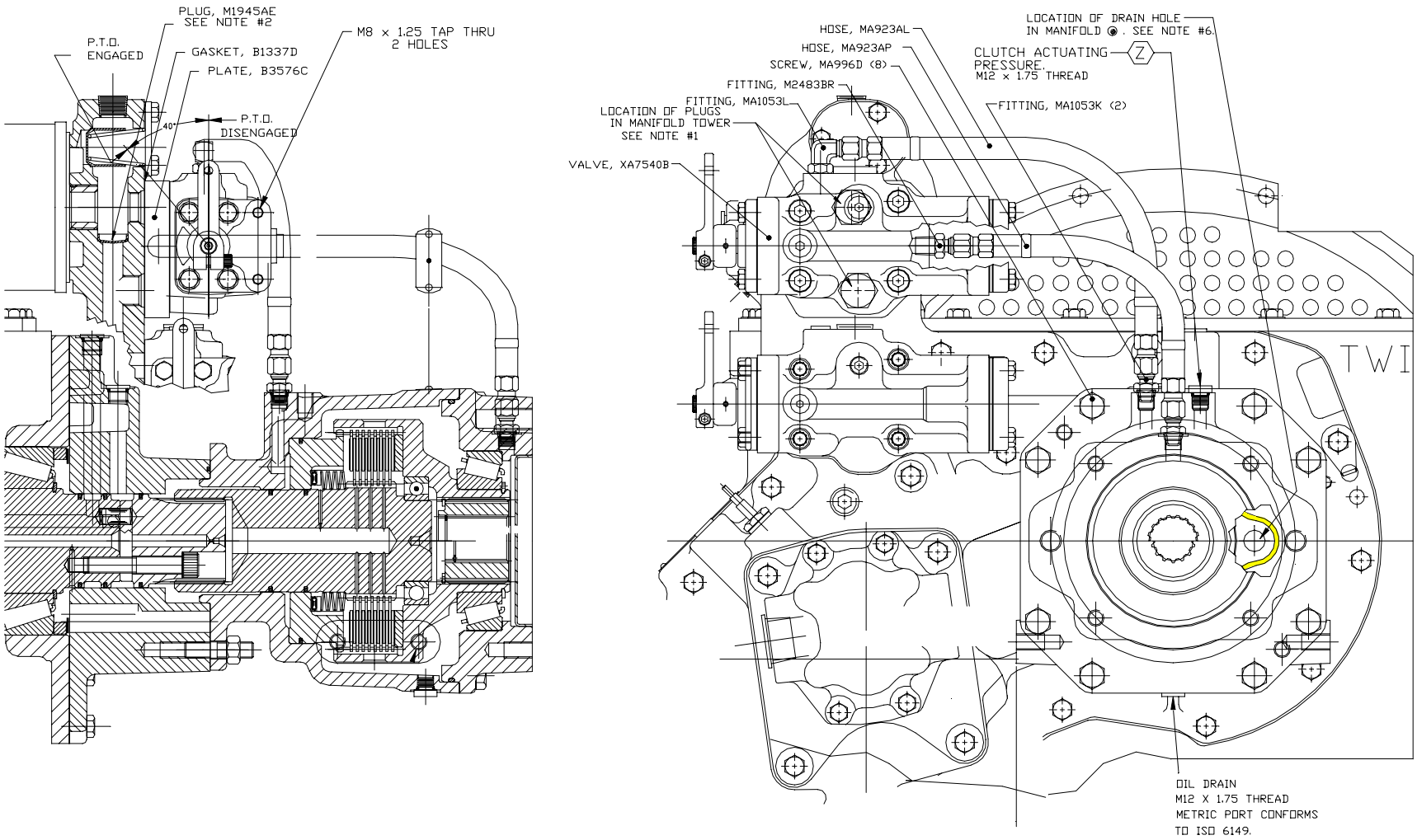
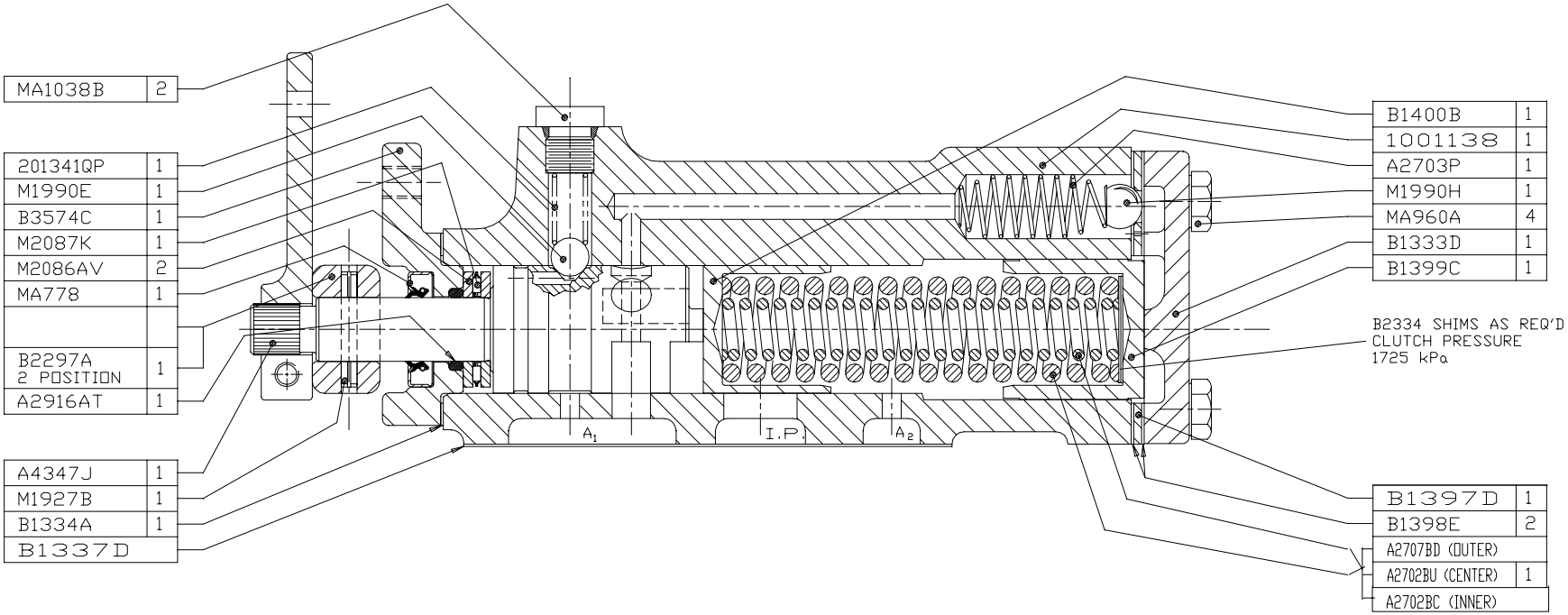

LOCATION OF DRAIN HOLE IN MANIFOLD
Z
CLUTCH ACTUATING PRESSURE. M12 x 1.75 THREAD PORT CONFORMS TO ISO 6149.
181.0 ø (REF.) H.C. SAE J744 No. 127-2
161.9 ø (REF.) H.C. SAE J744 No. 127-4
57.25
57.25
M12 X 1.75 TAP, 21.0 DEEP 4 HOLES EQUALLY SPACED
57.25
116.00
90.50
232.00
M16 x 2.0 TAP, 27.0 DEEP 2 HOLES, 180° APART
30°
"A" SPLINE 33.92 ø ±0.06 SAE J744 No. 38-4 PUMP DRIVE ADAPTER
16.0
75.00
"B" SPLINE 27.55 ø ±0.03 SAE J744 No. 32-4 PUMP DRIVE ADAPTER
127.06 ø ±0.03
MANIFOLD FACE
94.00
60.00
238.00
ADAPTER, 1017821 (SAE J744 No. 32-4)
M12 x 1.75 TAP, 21.0 DEEP 4 HOLES - 2 EACH SIDE
NOTE:
USE ALL 4 HOLES FOR MOUNTING A CUSTOMER SUPPLIED SUPPORT BRACKET TO THE P.T.O. USE 8.8 PROPERTY CLASS QUALITY CAPSCREWS PER ISO 898-1 AND TORQUE TO S574 OR SERVICE MANUAL VALUES.

Figure 2. Clutched Power Take-off Installation Dimensions



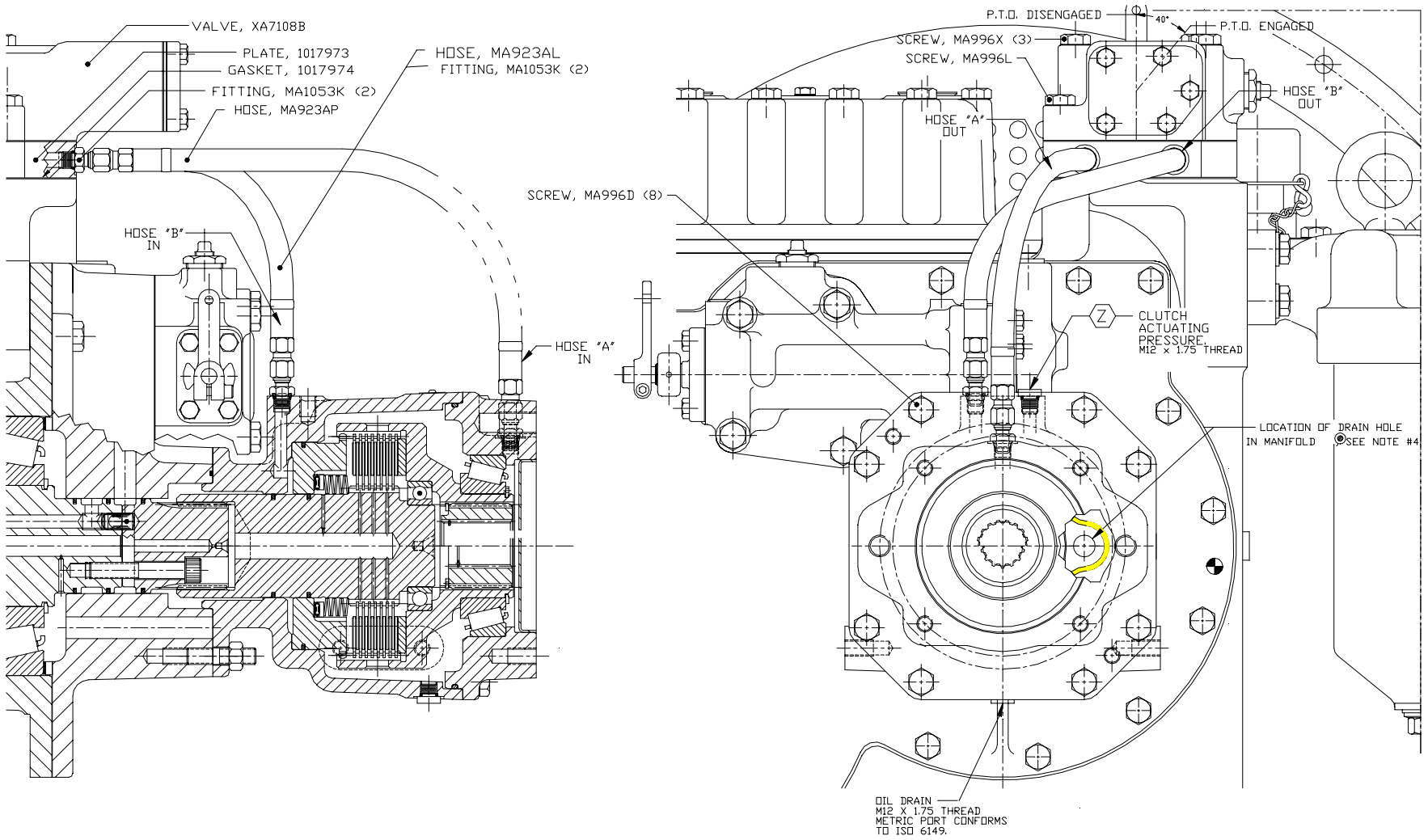
Refer to Bill of Materials for actual part number when ordering parts

Figure 3. Installation, MG516, MG5170, MG5202, with Mechanical Transmission Control



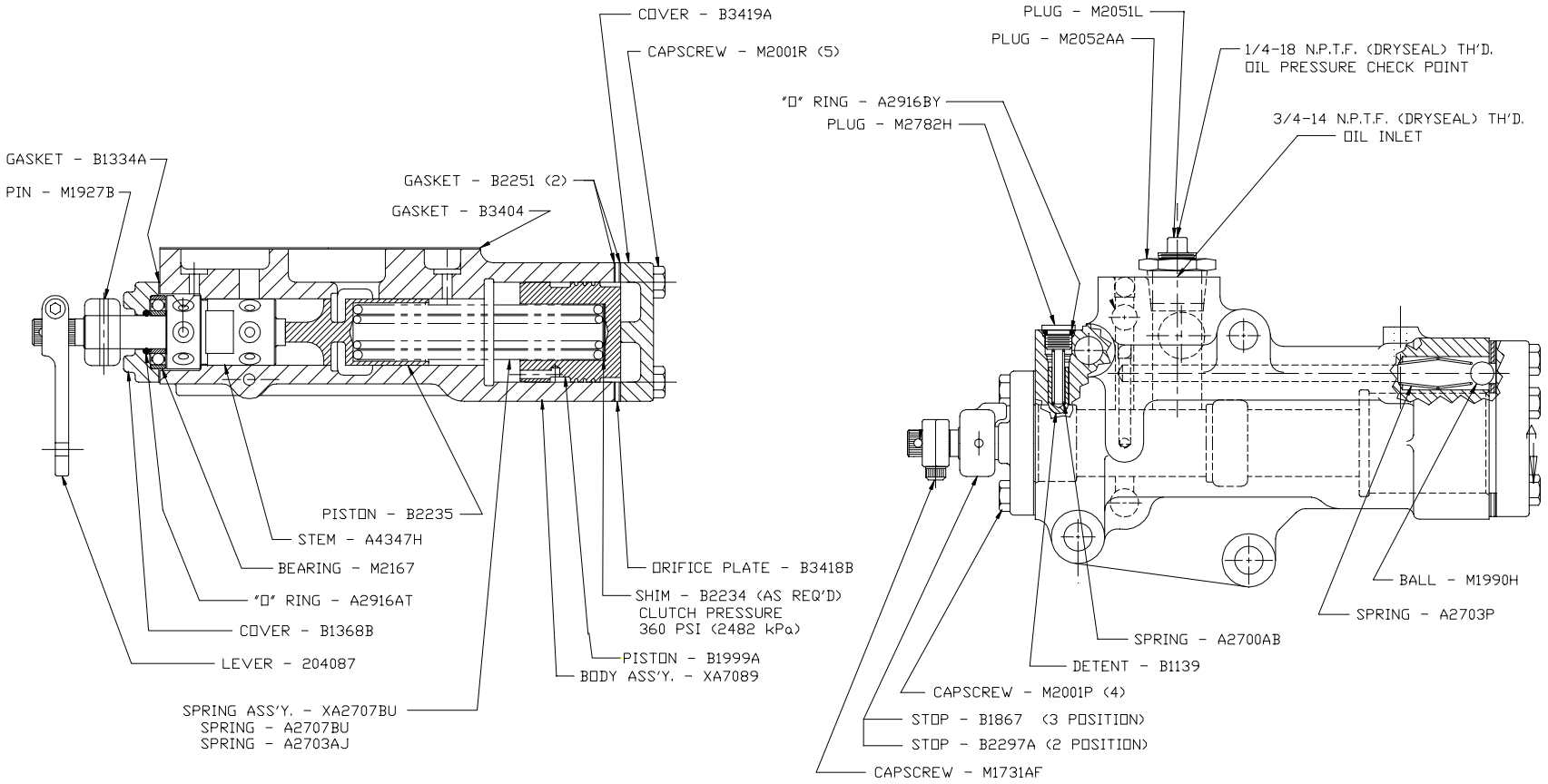
Refer to Bill of Materials for actual part number when ordering parts

Figure 4. PTO Valve for MG516, MG5170, MG5202, with mechanical transmission control



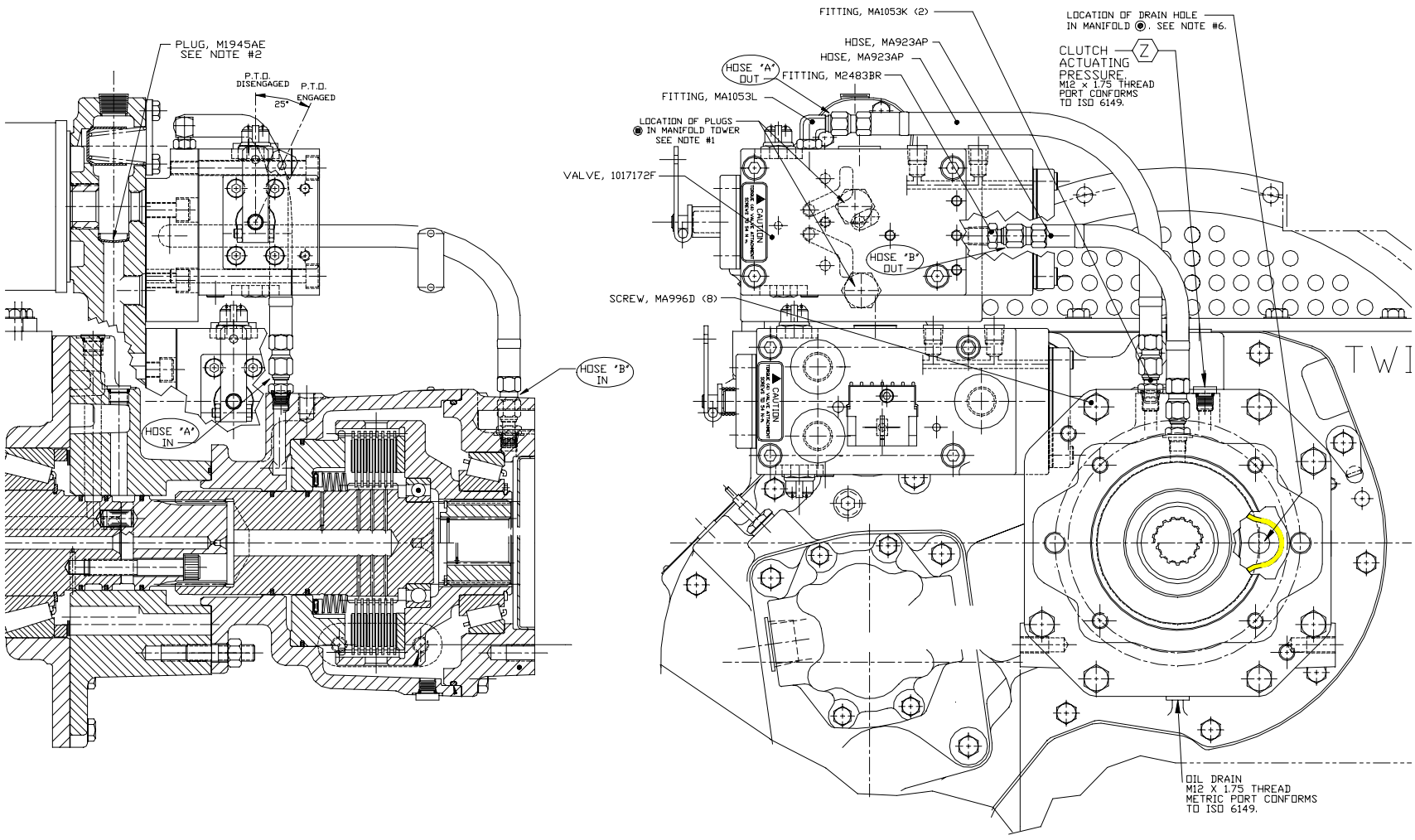
Refer to Bill of Materials for actual part number when ordering parts

Figure 5. Installation, MG5301DC with Mechanical Transmission Control Valve



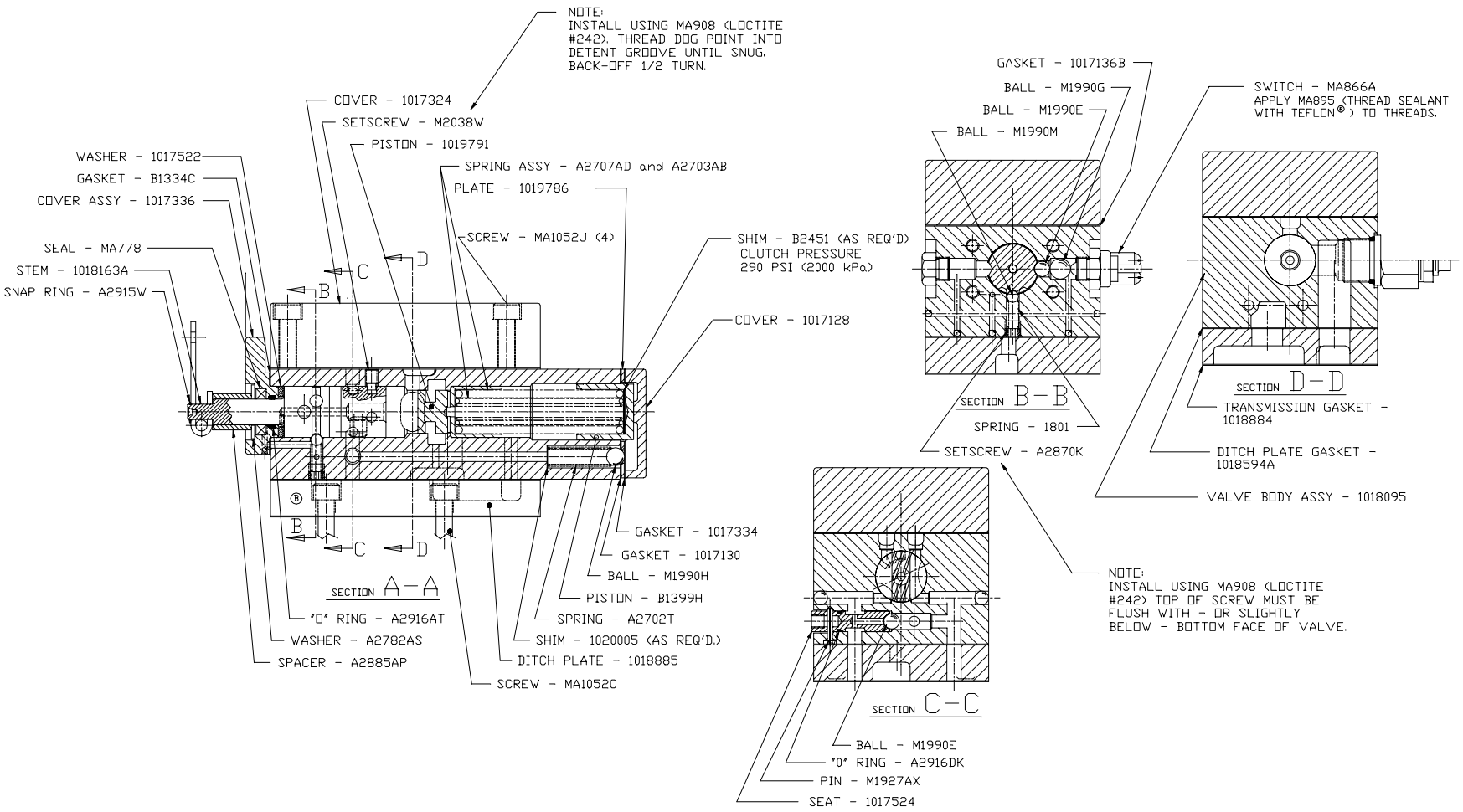
Refer to Bill of Materials for actual part number when ordering parts

Figure 6. PTO Valve for MG5301DC with Mechanical Transmission Control Valve



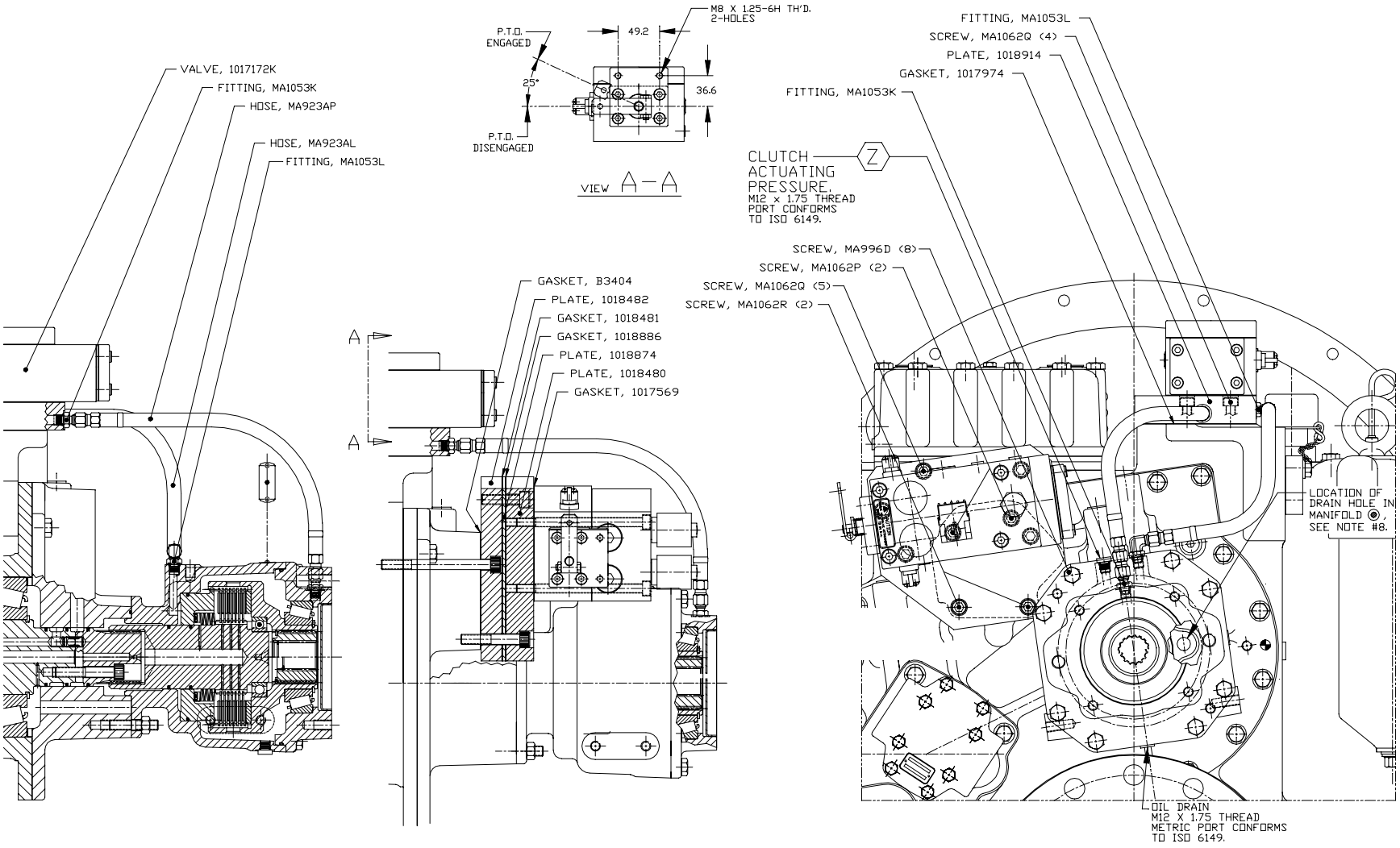
Refer to Bill of Materials for actual part number when ordering parts

Figure 7. Installation MG516, MG5170DC, MG5202DC, MG5205DC with Electric Transmission Control Valve with Mechanical Backup


NOTE:
INSTALL USING MA908 (LOCTITE #242). THREAD DOG POINT INTO DETENT GROOVE UNTIL SNUG. BACK-OFF 1/2 TURN.
COVER - 1017324
SETSCREW - M2038W
PISTON - 1019791
SPRING ASSY - A2707AD and A2703AB
PLATE - 1019786
SCREW - MA1052J (4)
WASHER - 1017522
GASKET - B1334C
COVER ASSY - 1017336
SEAL - MA778
STEM - 1018163A
SNAP RING - A2915W
SHIM - B2451 (AS REQ'D) CLUTCH PRESSURE 290 PSI (2000 kPa)
COVER - 1017128
GASKET - 1017334
GASKET - 1017130
BALL - M1990H
PISTON - B1399H
SPRING - A2702T
SHIM - 1020005 (AS REQ'D.)
DITCH PLATE - 1018885
SCREW - MA1052C
"O" RING - A2916AT
WASHER - A2782AS
SPACER - A2885AP
SECTION A-A
GASKET - 1017136B
BALL - M1990G
BALL - M1990E
BALL - M1990M
SECTION B-B
SPRING - 1801
SETSCREW - A2870K
SWITCH - MA866A
APPLY MA895 (THREAD SEALANT WITH TEFLON®) TO THREADS.
SECTION D-D
TRANSMISSION GASKET - 1018884
DITCH PLATE GASKET - 1018594A
VALVE BODY ASSY - 1018095
NOTE:
INSTALL USING MA908 (LOCTITE #242) TOP OF SCREW MUST BE FLUSH WITH - OR SLIGHTLY BELOW - BOTTOM FACE OF VALVE.
SECTION C-C
BALL - M1990E
"O" RING - A2916DK
PIN - M1927AX
SEAT - 1017524

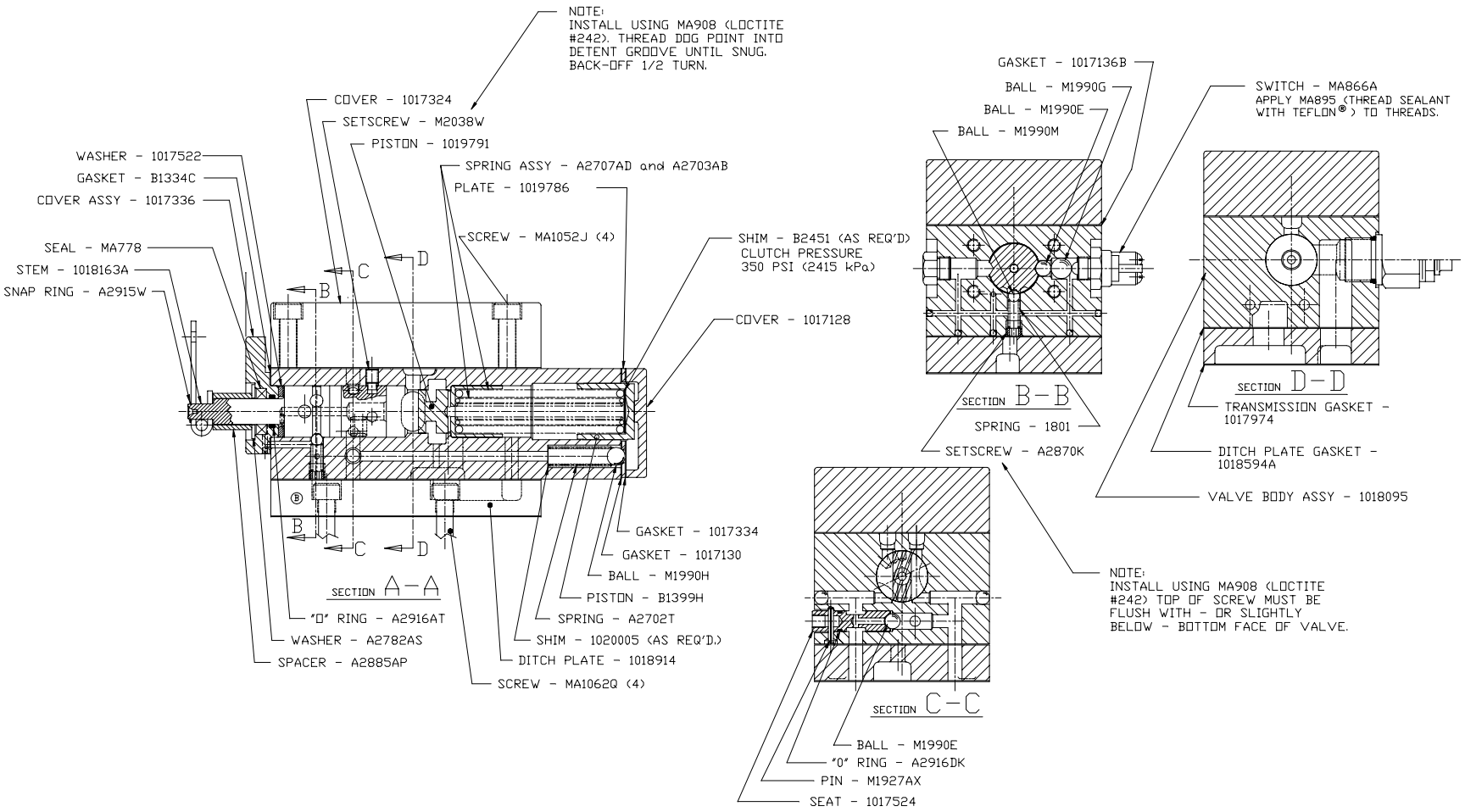
Refer to Bill of Materials for actual part number when ordering parts

Figure 8. PTO Valve for MG516, MG5170DC, MG5202DC, MG5205DC with Electric Transmission Control Valve with Mechanical Backup



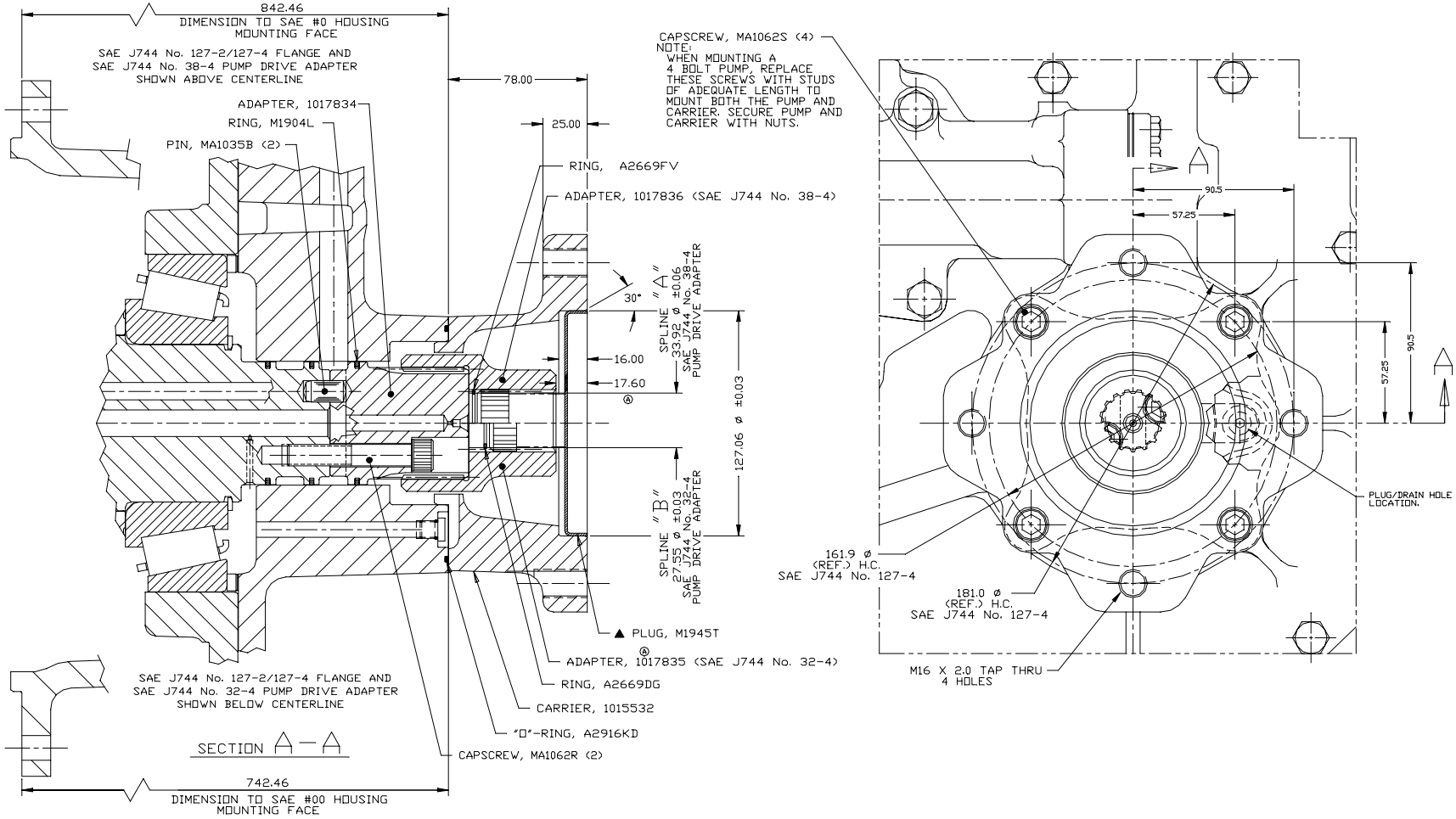
Refer to Bill of Materials for actual part number when ordering parts

Figure 9. Installation MG5301DC, MG6650-00-SC, MG6848-00-SC with Electric Transmission Control Valve


NOTE:
INSTALL USING MA908 (LOCTITE #242). THREAD DOG POINT INTO DETENT GROOVE UNTIL SNUG. BACK-OFF 1/2 TURN.
COVER - 1017324
SETSCREW - M2038W
PISTON - 1019791
SPRING ASSY - A2707AD and A2703AB
PLATE - 1019786
SCREW - MA1052J (4)
WASHER - 1017522
GASKET - B1334C
COVER ASSY - 1017336
SEAL - MA778
STEM - 1018163A
SNAP RING - A2915W
SHIM - B2451 (AS REQ'D) CLUTCH PRESSURE 350 PSI (2415 kPa)
COVER - 1017128
GASKET - 1017334
GASKET - 1017130
BALL - M1990H
PISTON - B1399H
SPRING - A2702T
SHIM - 1020005 (AS REQ'D.)
DITCH PLATE - 1018914
SCREW - MA1062Q (4)
"O" RING - A2916AT
WASHER - A2782AS
SPACER - A2885AP
SECTION A-A
GASKET - 1017136B
BALL - M1990G
BALL - M1990E
BALL - M1990M
SECTION B-B
SPRING - 1801
SETSCREW - A2870K
SWITCH - MA866A
APPLY MA895 (THREAD SEALANT WITH TEFLON®) TO THREADS.
SECTION D-D
TRANSMISSION GASKET - 1017974
DITCH PLATE GASKET - 1018594A
VALVE BODY ASSY - 1018095
NOTE:
INSTALL USING MA908 (LOCTITE #242) TOP OF SCREW MUST BE FLUSH WITH - OR SLIGHTLY BELOW - BOTTOM FACE OF VALVE.
SECTION C-C
BALL - M1990E
"O" RING - A2916DK
PIN - M1927AX
SEAT - 1017524

Refer to Bill of Materials for actual part number when ordering parts

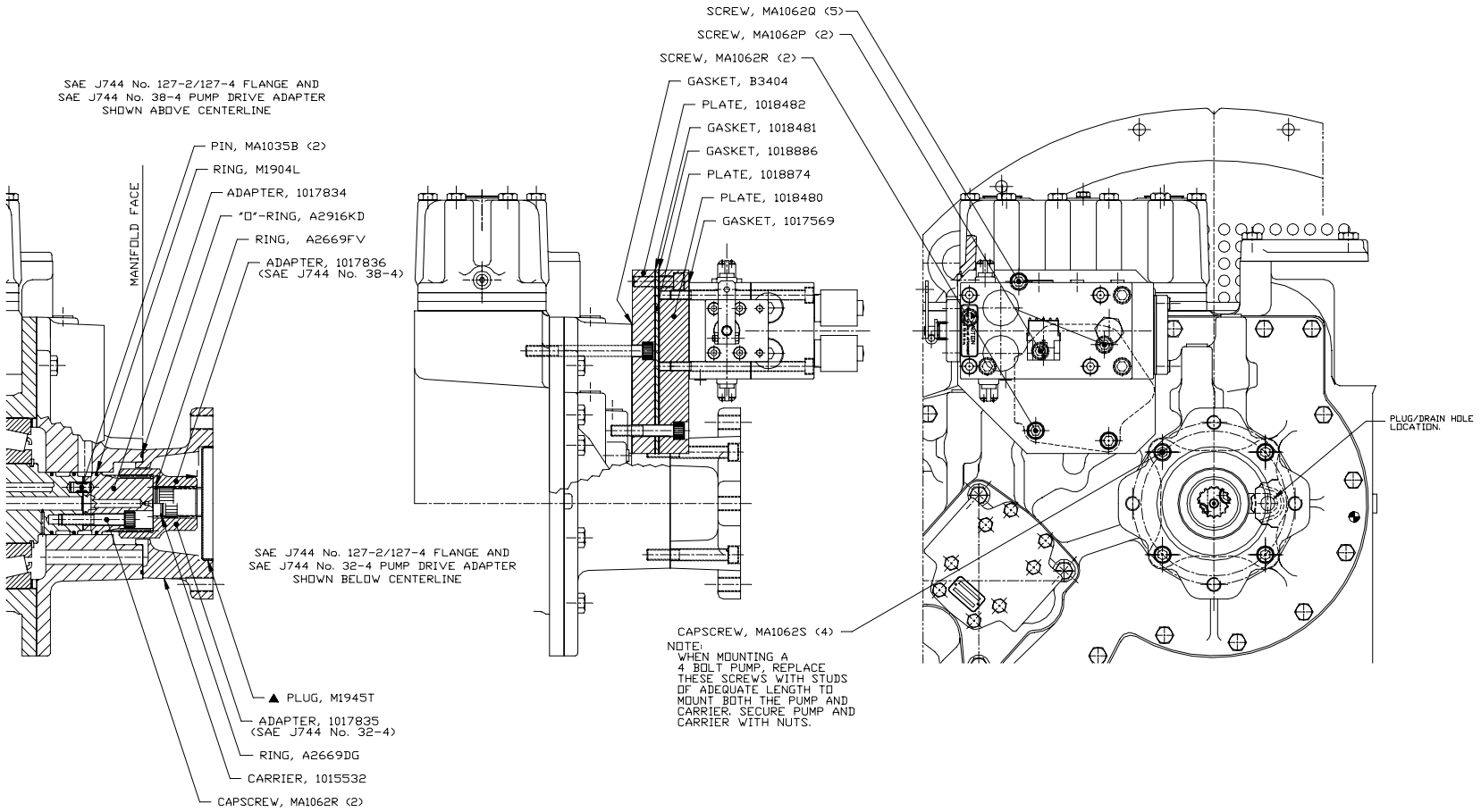
Figure 10. PTO Valve for MG5301DC, MG6650-00-SC, MG6848-00-SC with Electric Transmission Control Valve


842.46
DIMENSION TO SAE #0 HOUSING MOUNTING FACE
SAE J744 No. 127-2/127-4 FLANGE AND SAE J744 No. 38-4 PUMP DRIVE ADAPTER SHOWN ABOVE CENTERLINE
78.00
25.00
ADAPTER, 1017834
RING, M1904L
PIN, MA1035B (2)
RING, A2669FV
ADAPTER, 1017836 (SAE J744 No. 38-4)
CAPSCREW, MA1062S (4)
NOTE:
WHEN MOUNTING A 4 BOLT PUMP, REPLACE THESE SCREWS WITH STUDS OF ADEQUATE LENGTH TO MOUNT BOTH THE PUMP AND CARRIER. SECURE PUMP AND CARRIER WITH NUTS.
30°
"A" SPLINE 33.92 ø ±0.06 SAE J744 No. 38-4 PUMP DRIVE ADAPTER
16.00
17.60
Ⓐ
127.06 ø ±0.03
"B" SPLINE 27.55 ø ±0.03 SAE J744 No. 32-4 PUMP DRIVE ADAPTER
▲ PLUG, M1945T
Ⓐ
ADAPTER, 1017835 (SAE J744 No. 32-4)
RING, A2669DG
CARRIER, 1015532
"O"-RING, A2916KD
CAPSCREW, MA1062R (2)
SAE J744 No. 127-2/127-4 FLANGE AND SAE J744 No. 32-4 PUMP DRIVE ADAPTER SHOWN BELOW CENTERLINE
SECTION A—A
742.46
DIMENSION TO SAE #00 HOUSING MOUNTING FACE
90.5
57.25
90.5
57.25
PLUG/DRAIN HOLE LOCATION.
161.9 ø (REF.) H.C. SAE J744 No. 127-4
181.0 ø (REF.) H.C. SAE J744 No. 127-4
M16 X 2.0 TAP THRU 4 HOLES

Refer to Bill of Materials for actual part number when ordering parts

Figure 11. Live Power Take-off, All MG516, MG5170DC, MG5202DC, MG5202DC, and MG5301DC with Manual Transmission Control Valve Only

Installation Dimensions for all Live Power Take-offs



Refer to Bill of Materials for actual part number when ordering parts

Figure 12. Live Power Take-off, MG5301DC, MG6650-00-SC, MG6848-00-SC with Electric Transmission Control Valve

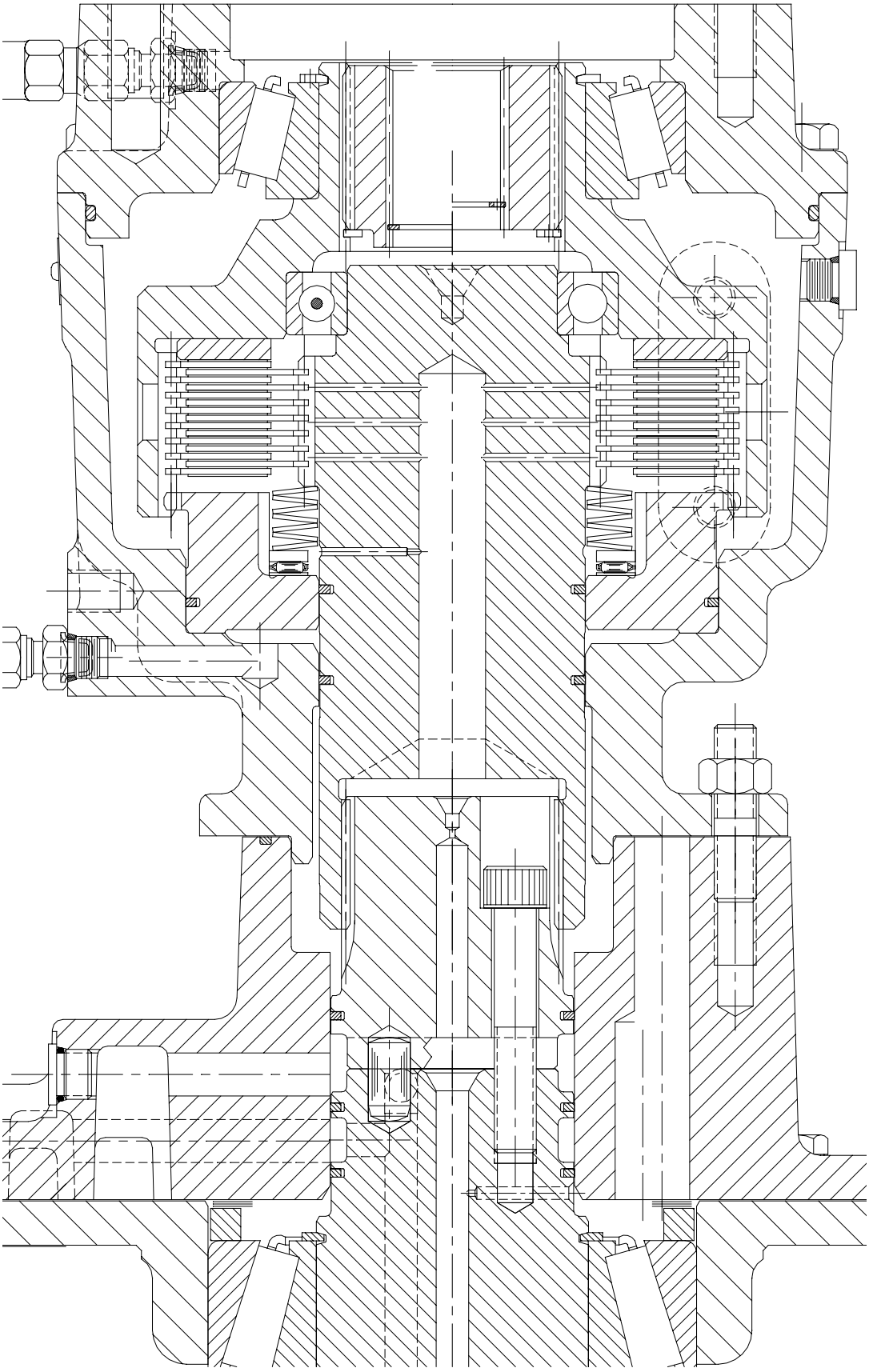


Figure 13. Clutch Cross Section, Expanded

Operation

General

The following information is intended for use by the operator. Instructions apply to the power take-off only. See the operators manual for information on the operation of the marine transmission.

Power Take-off Clutch Engagement Procedure

The clutchable power take-off can be engaged at engine speeds up to one half of the rated match point speed. The control valve has a built in rate of pressure rise, making it unnecessary to try and feather or slip the power take-off into engagement.

Clutch Adjustment

There are no clutch adjustments necessary for the power take-off. Make sure that the engagement linkage is adjusted such that full travel of the engaging lever results in the valve being in the detent position. See the Installation section.

Lubrication and Preventative Maintenance

General

Lubrication of the marine power take-off is accomplished internally with the marine transmission's oil. No external lubrication is required.

See the Installation section for proper adjustment of the shift lever of the clutchable power take-off control valve. There are no adjustments on the live power take-off.

A plug (M1945T) is supplied for sealing if the marine transmission is to be operated without a driven pump installed. This plug should have a thin coat of M2828 anaerobic sealant applied to the outer diameter prior to installation into the power take-off pilot bore. It should be pressed until flush with the rear face of the housing.

It is important that the alignment of the support plate be rechecked whenever it has been disconnected to insure that no side load is transmitted to the power take-off clutch housing.

Disassembly

General

Refer to the Bill of Material that is identified on the nameplate for the correct part numbers of the power take off assembly. If this is unknown, it may be obtained from your Twin Disc Authorized Distributor. A cross sectional drawing is shown in the Description and Specification section of this manual. Refer to this as a guide during disassembly of the power take-off.

Disassembly of Clutched Power Take-off

1. Remove the pump assembly from the power take-off.

2. Disconnect the supporting plate from the power take-off housing.

3. Disconnect two hoses from power take off housing. Remove the four MA947B nuts from the studs, and remove the power take-off housing from the marine transmission.

4. Place the power take off assembly face down, using appropriate blocks to support the power take-off on the front housing face and not the shaft.

5. Remove the eight (8) MA996D capscrews (M12x30) from the rear cover. The bearing outer race should remain in the cover.

6. Slide the pump spline adapter out and set aside.

7. Lift the 1717826 ring out of the housing. The inner race of the tapered roller bearing will provide a lifting means. Remove the A2915CF snap ring from the ring to remove the tapered roller bearing. This should be a slip fit.

8. Lift the shaft and ball bearing out of the bore, using care to not damage the seal rings on the spring inner diameter.

9. Remove the clutch plates and backing plate.

10. Remove seven (7) release spring washers and needle thrust bearing and races.

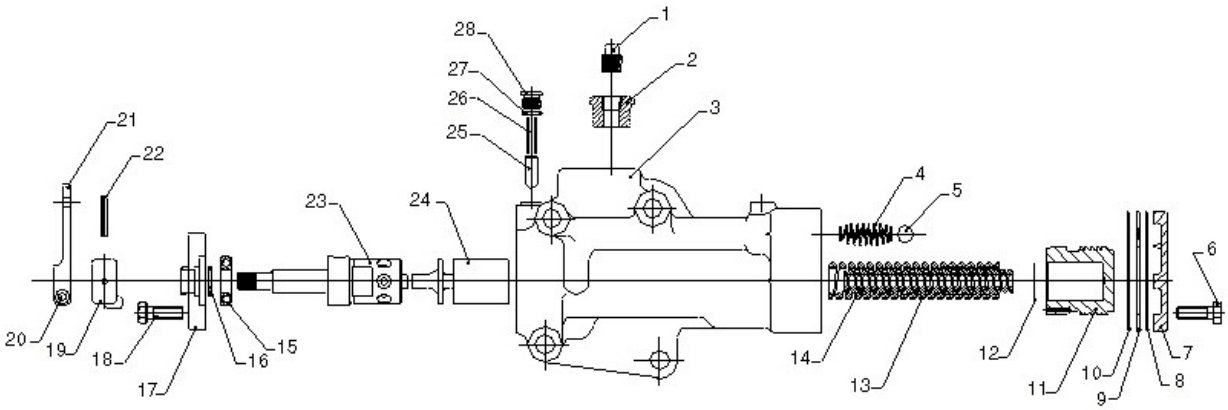
11. Remove the piston from the bore of the housing.

12. Remove the piston seal rings.

Disassembly of Valve

Note: All of the valves for the power take-off clutches are similar in construction, but part numbers vary. Refer to the appropriate valve drawing for specifics and Figure 4 as a guide in Description and Specifications.

Valve for MG516, MG5170, MG5202, MG5301DC with Mechanical Transmission Control Valve



1	Plug	11	Rate of Rise Piston	21	Lever
2	Bushing	12	Shim	22	Pin
3	Valve Body	13	Outer Spring	23	Valve Stem
4	Spring	14	Inner Spring	24	Piston
5	Check Ball	15	Bearing	25	Detent
6	Capscrew	16	O-Ring	26	Spring
7	Orifice Cover	17	Cover	27	O-Ring
8	Gasket	18	Capscrew	28	Plug
9	Orifice Plate	19	Collar		
10	Gasket	20	Capscrew		

Figure 14. Mechanical Selector Valve Exploded View

⚠ CAUTION

Steel ball is under pressure from the spring. Care must be taken when removing the cover and orifice plate to prevent loss of steel ball.

1. Remove the four 5/16-18 x 1.25 inch capscrews and remove the orifice cover, orifice plate, gaskets, check ball and spring.

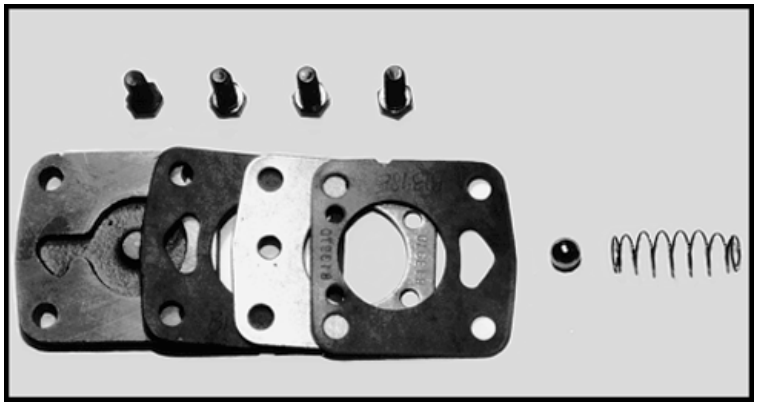


Figure 15. Cover, Gaskets, Orifice Plate, Check Ball and Spring

2. Remove the rate-of-rise piston, pressure regulating springs, and pressure regulator piston. The pressure regulator adjustment shims are in the spring pocket of the rate-of-rise piston.

3. Remove the O-ring plug, O-ring, detent spring, and detent.

4. Mark the lever and the stem to indicate the position the lever was installed on the stem. Loosen the screw clamping the shift lever to the stem and remove the lever. It may be necessary to splay the lever to be able to remove it. DO NOT apply any impact force to the lever, as the stem, lever, or bearing might get damaged.

5. Mark the stop and the stem to indicate the position the stop was installed on the stem. Drive the rollpin out of the stop with a drift punch, and remove the stop.

Figure 16. Drive Roll Pin Out of Stop

6. Remove the valve cover and valve stem.

7. Slide the valve stem out of the valve cover.

8. Remove the gasket and O-ring from the valve cover.

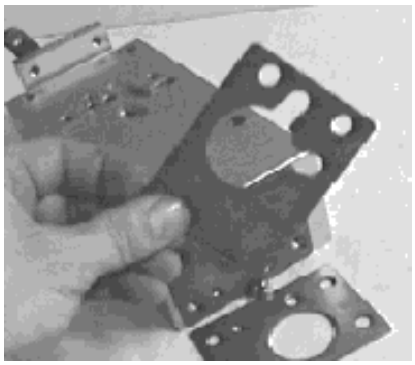
9. Remove the bearing from the valve stem.

Valve for MG516, MG5170DC, MG5202DC, MG5205DC, MG5301DC, MG6650-00-SC, MG6848-00-SC with Electric Transmission Control Valve with Mechanical Backup

⚠ CAUTION

Steel ball is under pressure from the spring. Care must be taken when removing the cover and orifice plate to prevent loss of steel ball.

1. Loosen and remove the four M8 x 25 socket head capscrews, and remove orifice plate cover and gasket



Figue 17. Orifice Plate and Gasket

2. Remove orifice plate.

3. Remove steel ball and neutral pressure regulating spring.

4. Remove orifice plate gasket.

5. Remove rate-of-rise piston. Note that shims are located between the piston and springs.

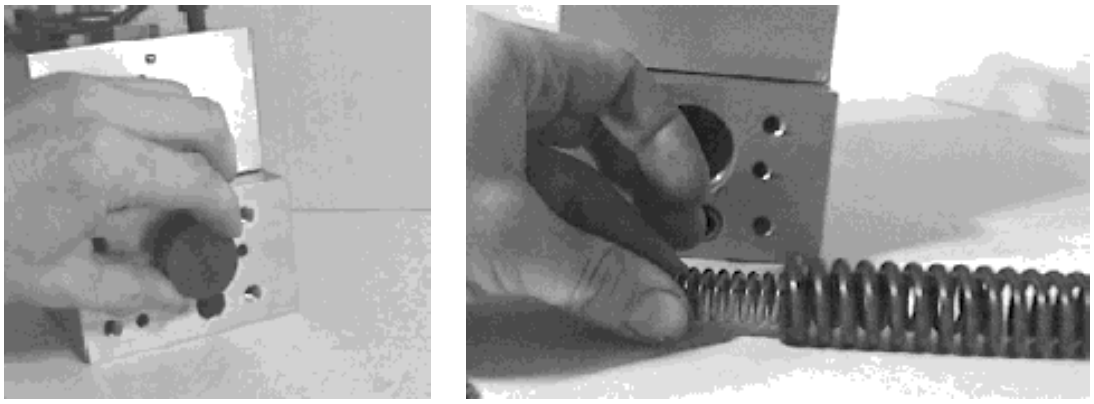


Figure 18. Rate of rise piston (left) and Regulator Springs (right)

6. Remove pressure regulating springs.

7. Remove pressure regulating piston with an external retaining ring pliers.

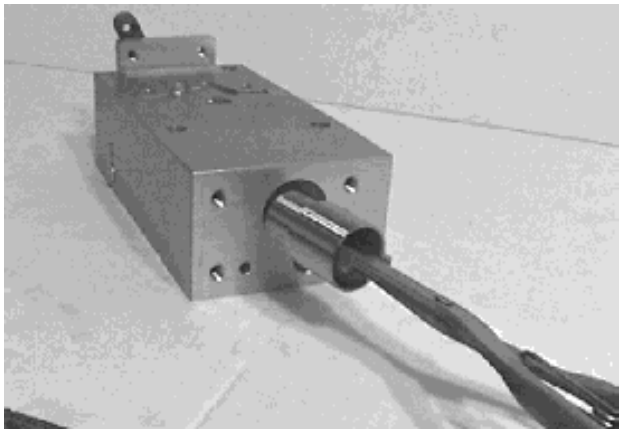


Figure 19. Removing Regulating Piston with Pliers

8. Remove external retaining ring from the lever end of the stem.

9. Loosen the clamping screw and nut and remove the control lever from the stem. It may be necessary to splay the lever to be able to remove it. DO NOT apply any impact force to the lever, as the stem or dog-point setscrew might get damaged.

10. Remove the washer and spring from the stem.

11. Remove the four M8 x 25 socket head capscrews.

12. Remove the cover assembly with gasket from the valve body.

13. Remove the O-ring and oil seal from the cover assembly.

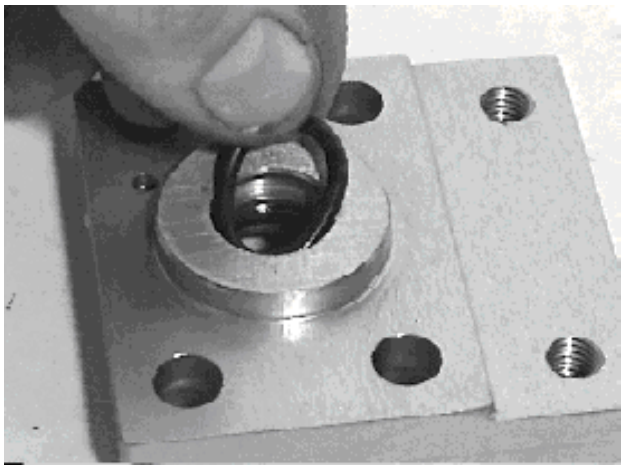


Figure 20. O-ring in Cover

14. Remove the two electrical switches from the sides of the valve body and the two steel balls from each of the switch bores in the valve body.

15. Remove the detent setscrew, spring, and steel ball from the valve body.

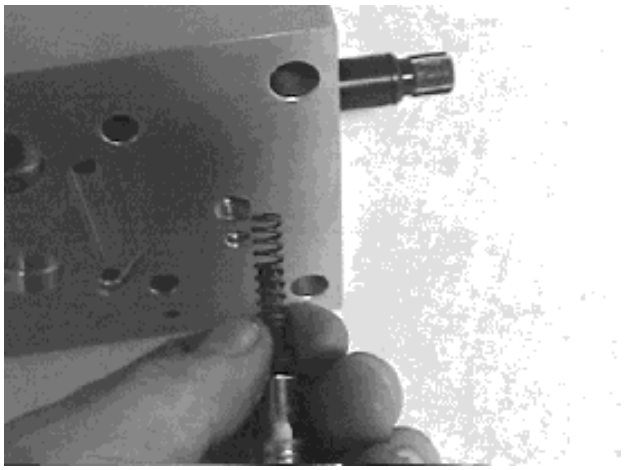


Figure 21. Detent Setscrew and Spring

16. Remove the dog-point setscrew. Note that the setscrew is retained with MA908 threadlocker.

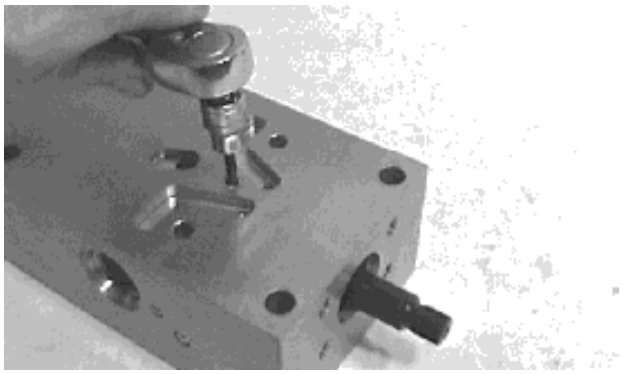


Figure 22. Dog-point Setscrew

17. Remove the stem from the valve body partially.

18. Remove the thrust washer from the stem.

Figure 23. Thrustwasher

19. Remove the stem from the valve body.

20. Remove the roll pin (retains the shuttle ball seat) with a needle-nose pliers.

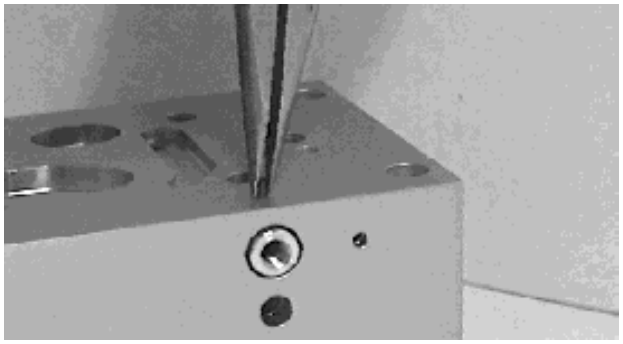


Figure 24. Roll pin retaining shuttle seat

21. Thread a M8x1.25 screw (one of the cover screws works well) into the seat and remove it from the valve body.

22. Remove the shuttle ball from the valve body.

Cleaning and Inspection

Cleaning

Note: Replace all oil seals, gaskets, O-rings piston rings, seal rings, snap rings, etc., as a part of any maintenance or overhaul procedure. Replace shims that are damaged or destroyed in disassembly.

Clean all parts using EPA/OSHA approved solvents or by steam cleaning. Parts must he dried and oiled immediately.

Examine all parts carefully for grit, dirt and abrasives and reclean them if necessary.

Clean all oil passages by working a piece of wire back and forth through the passages and then flushing them with cleaning solvent.

Use clean solvent to flush oil pumps, valves, etc.

Flush all hoses, tubing, coolers etc., particularly if the unit is being disassembled because of an internal failure.

De-burr the housing and cover with a stone or file if necessary in the vicinity of all pusher screw locations.

Cleaning Bearings

Do not remove grease in which new bearings are packed. Thoroughly wash bearings that have been in service. Soak bearings in solvent if they are particularly dirty or filled with hardened grease.

⚠ CAUTION

Never dry bearings with compressed air. Do not spin unlubricated bearings. Oil bearings with SAE 10 engine oil immediately after cleaning. Oil bearings before inspection.

Preventing Dirt from Entering into Bearings

Dirt and grit in bearings are often responsible for bearing failure; consequently, it is important to keep bearings clean. Do not remove grease from new bearings. Keep the wrapper on new bearings until they are installed. Do not expose clean bearings if they are not to be assembled at once. Wrap them with a clean lint-free cloth or paper to keep out dust.

Previously Sealed Joints

For previously sealed joints, scrape surfaces to remove old gasket material or sealant.

Clean surfaces with solvent to remove oil and grease residue.

Test for clean surfaces by applying a few drops of cool water to the surfaces. Parts are sufficiently clean if water covers the surface in a film. If the water puddles or forms beads, use fresh solvent and reclean.

Inspection

Housings, Cast Parts, and Machined Surfaces

Replace cast parts or housings that are cracked.

Inspect bores for wear, grooves, scratches and dirt. Remove burrs and scratches with crocus cloth or soft stone. Replace deeply grooved or scratched parts. Do not remove excess material by sanding. This will change the designed fit of bearings, races, or seal rings.

Inspect oil passages for obstructions. If you find an obstruction, remove it with compressed air or work a wire back and forth through the passage and flush it with solvent.

Inspect machined surfaces for burrs, scratches, nicks and foreign matter. If you cannot remove the defect with crocus cloth or a soft stone, replace the part.

Inspect threaded openings for damaged threads. Chase damaged threads with a tap of the correct size.

Inspect studs for damaged threads and looseness. Replace defective studs.

Inspect dowel pins for wear or damage. Replace defective dowels. This applies where a matched set of parts is not involved.

Inspect dowel pin holes for wear due to movement between mating parts. If a dowel pin hole is worn, re-bore and sleeve the hole when possible. Otherwise, replace the parts. This applies where a matched set of parts is not involved.

Valve Seats

Inspect valve seats for burrs, nicks and scratches. If you cannot remove these defects with a crocus cloth, replace the part. Check to see that the valve is seating properly after reworking the valve seat.

Bearings

Inspect bearings for roughness of rotation. Replace the bearing if the rotation is rough.

Inspect bearings for corrosion, and for indication of wear of balls or rollers. Inspect for scored, scratched, cracked, pitted or chipped races. If you find one of these defects, replace the bearing.

Inspect bearing bores and shafts for grooved, burred, or galled conditions that would indicate the bearing has been turning in its housing or on its shaft. If you cannot repair the damage with a crocus cloth, replace the part.

Bushings and Sleeves

Inspect bushings for size and out-of-roundness. Inspect for scores, burrs, sharp edges, and evidence of overheating. Remove scores with a crocus cloth. If the bushing is out-of-round, deeply scored, or excessively worn, replace it.

Thrust Washers and Spacers

Inspect thrust washers for distortion, scores, burrs and wear. Rework or replace any defective thrust washers or spacers.

Gears

Inspect gears for scuffed, nicked, burred or broken teeth. If you cannot remove the defect with a soft stone, replace the gear.

Inspect gear teeth for wear that may have destroyed the original tooth shape. If you find this condition, replace the gear.

Inspect thrust faces of gears for scores, scratches and burrs. If you cannot remove these defects with a soft stone, replace the gear.

Splined Parts

Inspect splined parts for stripped, twisted, chipped or burred splines. Remove burrs with a soft stone. Replace the part if other defects are found.

Springs

Inspect springs for broken or distorted coils. Replace the spring if either of these defects is found.

Flexible Hoses

Inspect all flexible hoses for cracks and sponginess. Replace damaged hoses.

Clutch Plates

Inspect clutch plates for signs of overheating, pitting, or excessive wear of the friction and splined surfaces. Replace the clutch plates if one of these defects is found. Refer to wear limits in Description and Specifications.

Seal Ring Bores

Inspect the seal ring bores for evidence of the seal ring spinning within the bore. If any groove exists that is deep enough to feel with a fingernail, replace the parts as necessary to restore a correct fit of the seal ring.

Lip Seal Surfaces

Inspect the seal surfaces for grooving, scratches, or burrs. Remove any damage by polishing, being careful to not introduce any lead that could result in oil being pumped out past the seal. In some instances seal surfaces can be reconditioned or renewed with the use of a “Speedi-Sleeve”.

Assembly

General

A cross sectional drawing is shown in the Description and Specifications section of this manual. Part numbers that are listed on those drawings and on the following assembly notes are for reference only, and should not be used for ordering repair parts. Refer to these part numbers as a guide during assembly of the power take-off. Identify correct replacement repair parts by referring to the Bill of Material that is identified on the nameplate. If this is not available, it may be obtained from your Twin Disc Authorized Distributor.

Assembly of Clutched Power Take-off

1. Press the M1989 tapered roller bearing cone assembly on the 1017826 ring, and install theA2915CF external retaining snap ring. See Figure 25 left.

2. Press the M2898 ball bearing onto the 1017827 shaft. See Figure 25 right.

Figure 25. Bearing with Snap Ring (left) and Ball Bearing On Shaft (right)

3. Press the M1989 tapered roller bearing cup into the 1017823 cover. See Figure 26 left.

4. Install the A2916FW o ring in the groove of the 1017823 cover. See Figure 26 right.

Figure 26. Install Bearing Cup (left) and Install O-ring (right)

5. Install the B1048AK internal snap ring into the splined bore of the 1017826 ring. See Figure 27 left.

6. Place the rear cover with the rear face down, and apply a coat of oil to the bearing cone, and place the 1017826 ring assembly into the rear cover. See Figure 27 right.

Figure 27. Installing Snap Ring (left) and Installing Ring With Bearing (right)

7. Install the two M1904E sealing rings into the grooves of the shaft and carefully hook the ends. Lubricate the seal rings, and insert the shaft and bearing into the bore of the 1017826 ring. See Figure 28 left.

8. Soak the friction plates in oil for at least one hour prior to installing them into the power take-off. Insert the 1017822 backplate, followed by an A4480Q friction plate, and an A4481A steel plate. Install an additional seven friction plates, and six steel plates, alternating such that there is a steel plate between each friction plate. A friction plate will be the last plate installed. See Figure 28 right.

Figure 28. Installing Seal Rings (left) and Install Clutch Plates (right)

10. Install the seven B1783N belleville spring washers as shown in Figure 13. The first spring must be installed with the convex end against the shoulder of the shaft, and the the next spring with the concave end first so that the two contact each other only at the outer diameter. Alternately, install the remaining springs such that the springs are not parallel to each other, and the maximum overall spring length results. See Figure 29 left.

11. Install the 202265B race (thick), followed by the M2087P needle bearing, and the M2086CY race (thin), coating each with a film of assembly lube. See Figure 29 right.

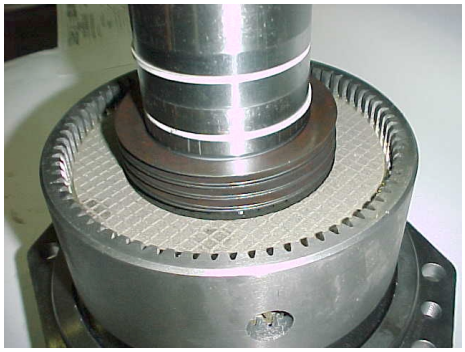


Figure 29. Belleville Springs installed (left) and Installing Bearing and Races (right)

12. Install the M1904C piston seal ring on the 1017825A piston, and install the piston into the ring. See Figure 30 left.

13. Make sure the seal rings and o-ring in cover are lubricated, and install the 1017824 housing over the clutch assembly, aligning the housing such that the drain hole of the housing is opposite the external hose ports on the rear cover. The use of M12 alignment studs is recommended. See Figure 30 right.

Figure 30. Install Piston Seal Ring (left) and Installing Housing (right)

14. Install the eight MA996D capscrews (M12 x 30 class 10.9), and torque to 83 lb-ft (112 Nm) with the threads lubricated with a light oil film. See Figure 31.

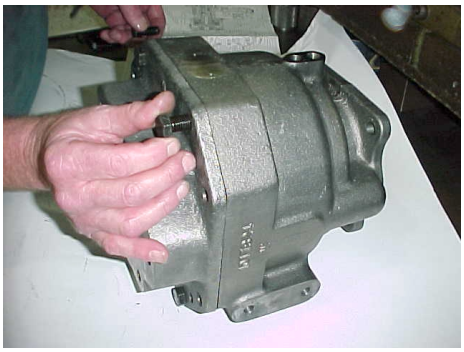
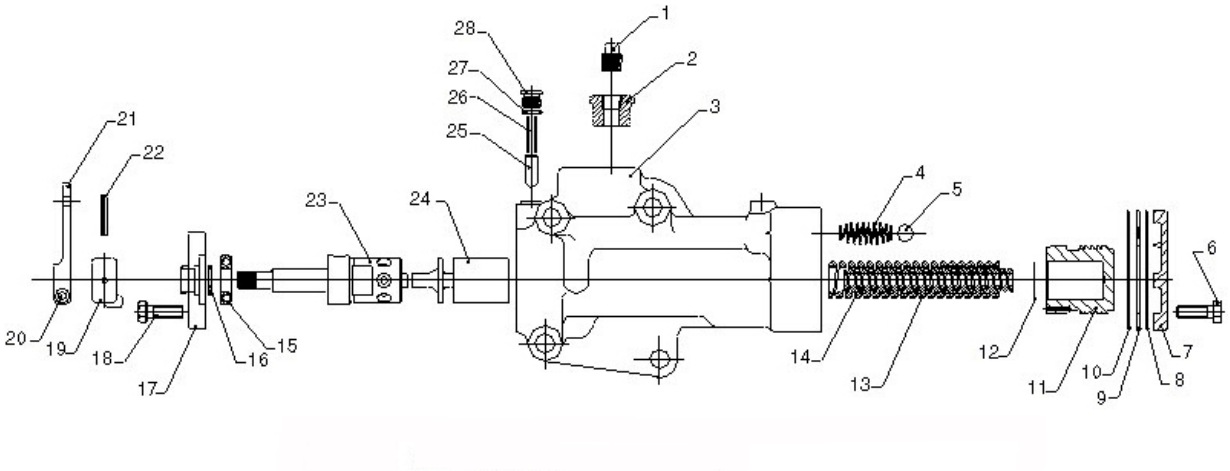


Figure 31. Installing Housing Capscrews

Assembly of Valve

Note that all of the valves for the power take off clutches are similar in construction, but part numbers vary. Refer to the appropriate valve drawing in the Description and Specifications section for specifics, and refer to Figure 4 and the illustration below as a guide.



1	Plug	11	Rate of Rise Piston	21	Lever
2	Bushing	12	Shim	22	Pin
3	Valve Body	13	Outer Spring	23	Valve Stem
4	Spring	14	Inner Spring	24	Piston
5	Check Ball	15	Bearing	25	Detent
6	Capscrew	16	O-Ring	26	Spring
7	Orifice Cover	17	Cover	27	O-Ring
8	Gasket	18	Capscrew	28	Plug
9	Orifice Plate	19	Collar		
10	Gasket	20	Capscrew		

Figure 32. Mechanical Selector Valve Exploded View

Valve for MG516, MG5170, MG5202, MG5301DC with Mechanical Transmission Control Valve

1. Install the bearing onto the valve stem.

2. Install the O-ring into the counterbore in the valve cover. Coat the O-ring and the stem with light assembly grease.

3. Install the valve stem into the valve cover. Use caution to prevent damage to the O-ring and bearing.

4. Install the cover gasket and valve stem and cover assembly onto the valve body.

5. Install the four of 5/16-18 x 1.25 capscrews, and torque to 20 Nm (15 lb-ft.).

6. Install the stop and rollpin, lining up the marks made at disassembly. Use small punch to line up the rollpin hole in the stop with the corresponding hole in the stem. Continue to hold the holes in alignment as the rollpin is driven into place. Support the stop while driving in the roll pin to prevent damage to the stem and valve.

7. Install the shift lever onto the stem, lining up the marks made at disassembly. Torque the screw to 15 Nm (11 lb-ft.).

8. Install the pressure regulator piston, regulating springs, shims and rate-of-rise piston into the bore in the valve body.

9. Install the spring and check ball, orifice plate gasket. Install the orifice plate with the chamfered side of the hole (check ball seat) toward the check ball. Install the cover gasket, cover, and four of 5/16-18 x 1.00 inch capscrews, and torque to 20 Nm (15 lb-ft.).

Valve for MG516, MG5170DC, MG5202DC, MG5205DC, MG5301DC, MG6650-00-SC, MG6848-00-SC with Electric Transmission Control Valve with Mechanical Backup

1. Install the steel shuttle ball into its bore in the valve body.

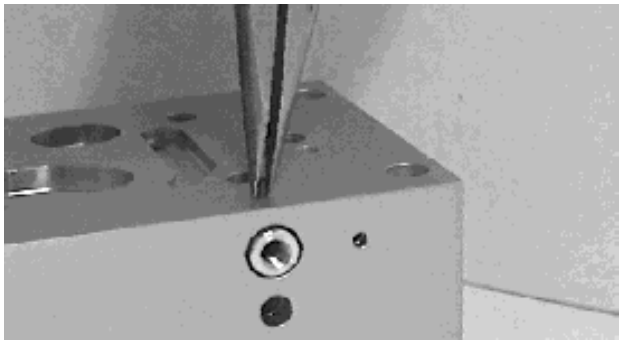


Figure 33. Shuttle Ball, Shuttle Seat, and Roll Pin

2. Install the O-ring onto the shuttle ball seat.

3. Apply lubricant such as Dow Corning 200® 30,000cSt fluid to the O-ring, and install the seat into the valve body. Be sure to align the roll pin holes in the seat with the holes in the valve body. A M8x1.25 screw threaded into the seat can be used to adjust the seat location in the valve body.

4. Install the roll pin to retain the shuttle ball seat. Drive the roll pin in until it is flush with the gasket surface of the valve body.

5. Install the stem into the valve body, aligning the slot in the stem with the threaded hole in the valve body for the dog-point setscrew. Be sure the slot in the stem is aligned with the setscrew hole in the valve body to prevent damage to the stem and valve body.

6. Apply MA908 threadlocker to the threads of the dog-point setscrew and install. Tighten the dog-point setscrew until snug, then back off 1/2 turn.

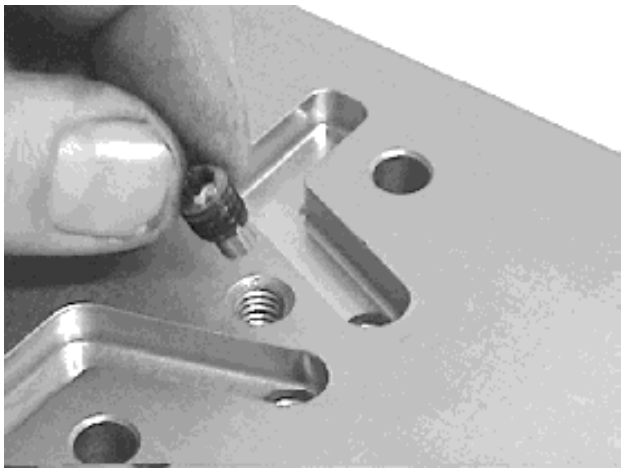


Figure 34. Dogpoint Setscrew with Threadlocker

7. Install the steel detent ball into the valve body.

8. Install the detent spring over the detent ball.

9. Apply MA908 threadlocker to the threads of the hollow setscrew and install into the threaded hole. A stepped Allen wrench, or one wrapped with tape will ease the installation of the hollow setscrew. Tighten the setscrew until it is flush with the gasket surface of the valve body. Check the stem rotation and detent action.

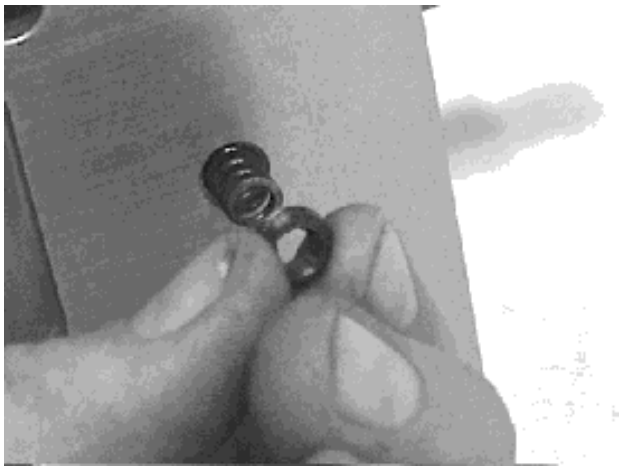


Figure 35. Detent Ball, Spring, Hollow Setscrew

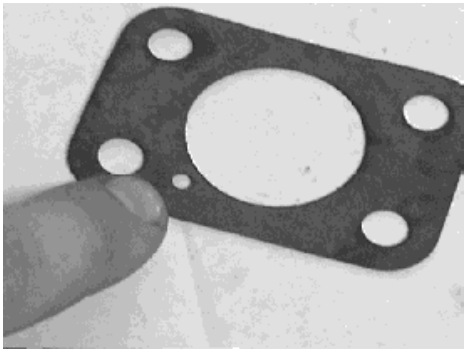
10. Install the thrust washer over the end of the stem.

11. Press the oil seal into the cover assembly until flush with the adjacent cover surface.

12. Install the O-ring into the counterbore in the cover assembly.

13. Apply grease to the stem, O-ring, and oil seal lip.

14. Install cover assembly and gasket onto valve body. Be sure to align the oil drain hole in the gasket with the hole in the valve body.



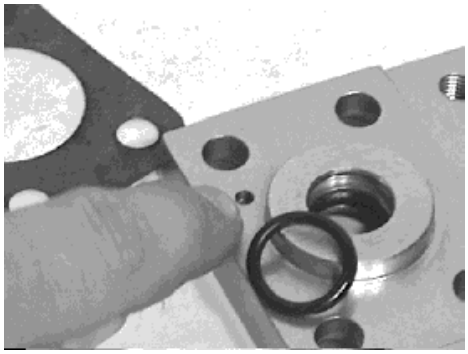


Figure 36. Hole in Gasket and Hole in Cover Must Align

15. Install four M8 x 25 socket head capscrews and torque to 23 Nm (17 lb-ft).

16. Install washer over stem and against oil seal.

17. Install spring over stem against washer.

18. Install lever onto the stem. It may be necessary to splay the lever to be able to install it. DO NOT apply any impact force to the lever, as the stem or dog-point setscrew may be damaged. Torque the lever's attaching screw to 9.5 Nm (7lb-ft).

19. Install external retaining ring onto stem .

20. Install the steel balls and electrical switches into the bores in the sides of the valve body. Note that the small diameter ball is inboard of the large diameter ball at each switch location.

21. Install the pressure regulating piston into valve body with spring pocket out.

22. Install pressure regulating springs into valve body and into piston spring pocket.

23. Install the shims that were removed into the bore of the rate-of-rise piston. Install the rate-of-rise piston over the springs and into valve body.

24. Install neutral pressure regulating spring into the pocket of valve body.

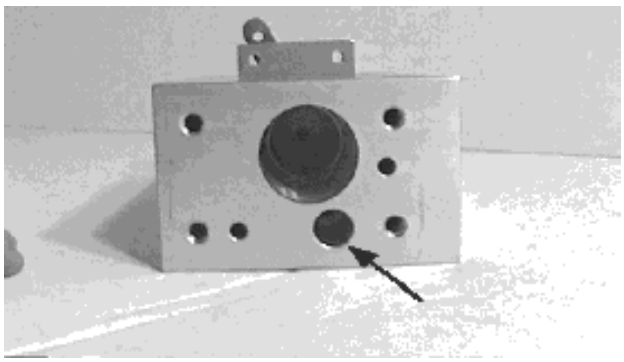


Figure 37. Location for Neutral Pressure Regulating Spring

25. Install orifice plate gasket onto valve body.

26. Install orifice plate and steel ball (against spring) onto valve body.

27. Install orifice plate cover and gasket onto valve body. Install four of M8 x 25 socket head capscrews and torque to 23 Nm (17 lb-ft).

28. Install gasket over lower valve body half.

29. Set upper valve body half over lower valve body half. Insert the M10 x 150 attaching screws through valve body halves to keep parts in alignment until installation onto the transmission. When installing the valve onto the transmission, torque the screws to 54 Nm (40 lb-ft.).

Installation

These PTO's are designed for use with Twin Disc marine transmissions. They are available in clutchable and live configurations. The marine transmission is available with the power take-off installed at the factory, or as a field installation kit. There are several versions of the power take-off installation groups, however the only differences concern the mounting and engaging interface with the various models of marine transmission. Refer to the section that pertains to the appropriate model of marine transmission.

Preparation

1. The installation of the power take-off requires exposure of internal passages to the possibility of contamination. Prior to beginning with the installation, clean the marine transmission and surrounding area.

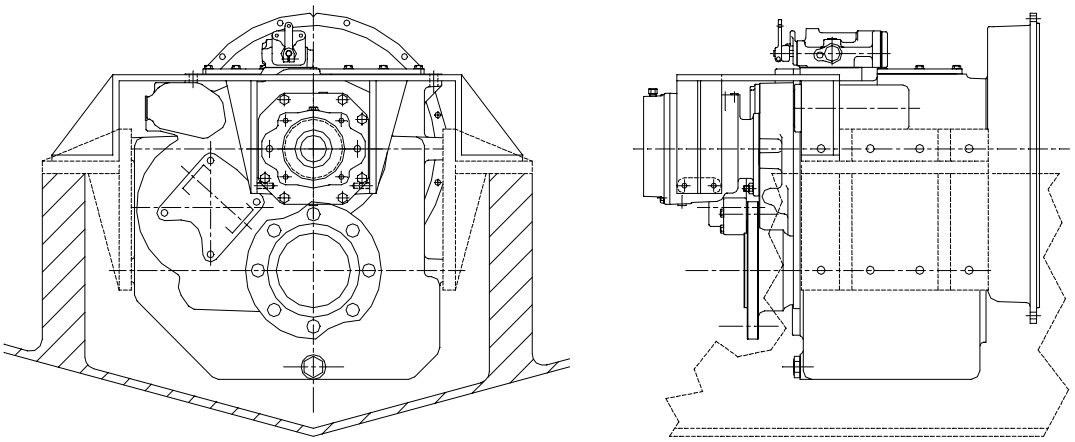
2. A support plate is required on all clutchable power take-off installations. The support plate must prevent any relative movement of the power take-off in relation to the marine transmission. The ideal installation would support the power take-off from the marine transmission mounting plate that is attached to the side of the marine transmission. Provisions should be made for the support plate mounting at this time. See Figure 14.

Installation to Marine Transmission

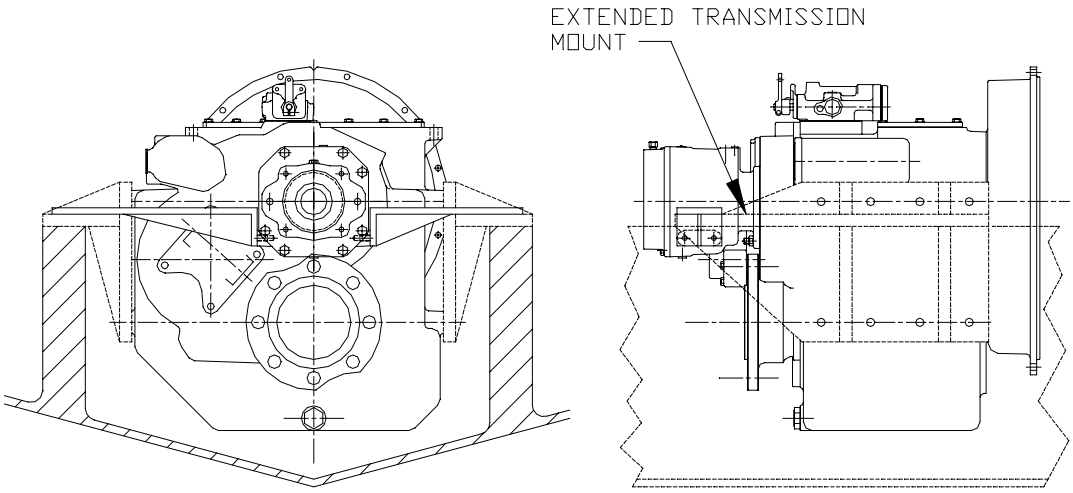
The installation procedures depend on the model of the marine transmission and whether it is equipped with a mechanical or electrical control valve. Be sure and follow the appropriate instructions that are listed later in this section of this manual.

Clutchable Power Take-off

The parts for this clutchable power take-off are the same for all marine transmission models, and is shown in Figure 1. The installation dimensions for the clutchable power take-off are also the same for all transmission models, and are shown in Figure 2. Additional installation parts are necessary, depending on the transmission model. The figures that identify these additional parts are referred to in the following paragraphs. Note that the part numbers shown are for reference only, and a current bill of material should be used to order the proper parts.



RECOMMENDED



RECOMMENDED

Figure 38. Recommended Support Plate Configurations

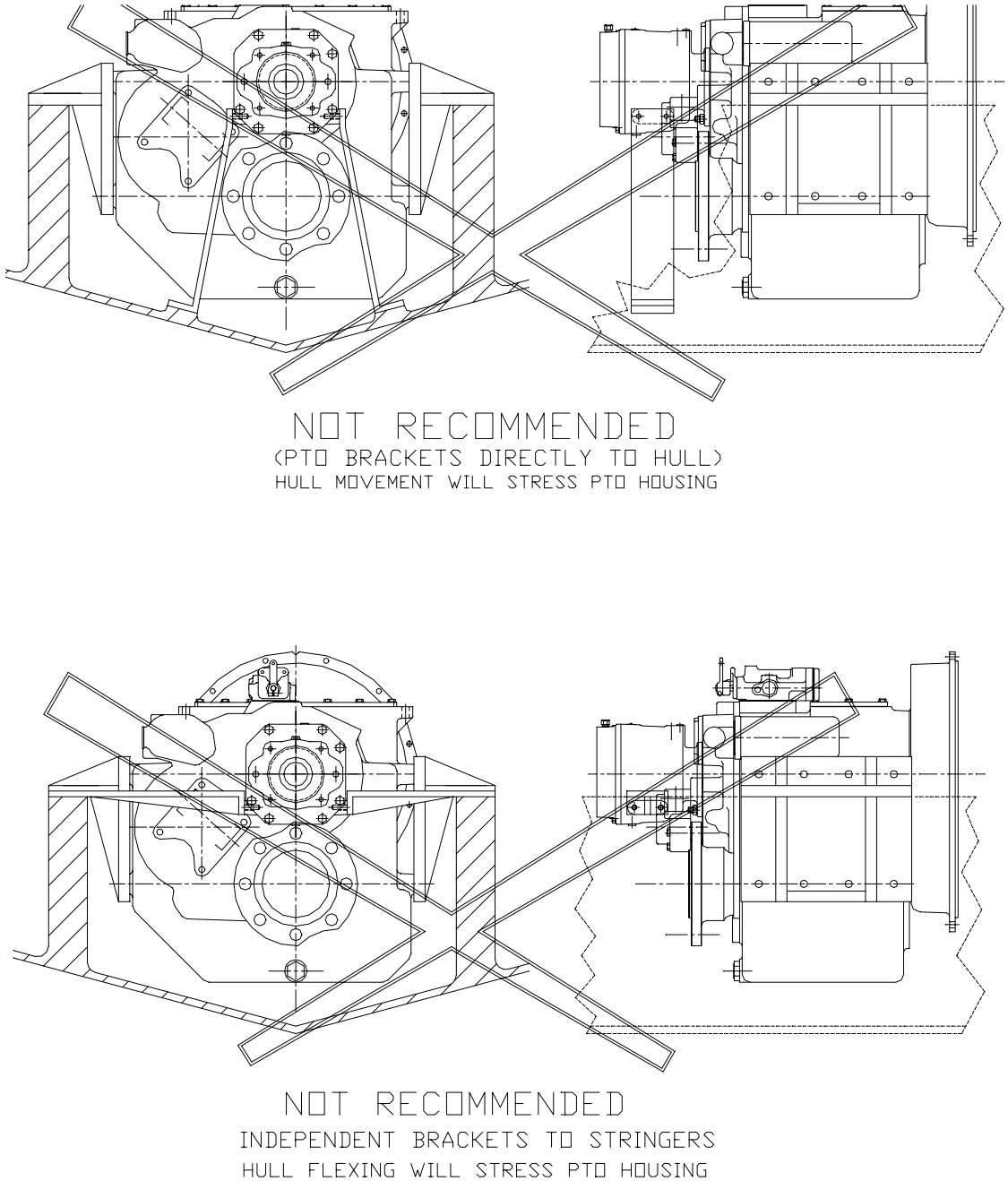

NOT RECOMMENDED
(PTO BRACKETS DIRECTLY TO HULL)
HULL MOVEMENT WILL STRESS PTO HOUSING
NOT RECOMMENDED
INDEPENDENT BRACKETS TO STRINGERS
HULL FLEXING WILL STRESS PTO HOUSING

Figure 39. Support Plate Configurations Not Recommended

⚠ CAUTION

Do not use any flexible mounting for PTO support.

MG516, MG5170DC, MG5202, with Mechanical Transmission Control Valve

Refer to Figure 3.

1. Remove the cover from rear of marine transmission at the input shaft centerline. Remove and discard the o-ring. Remove two o-ring plugs from the transmission manifold tower. Remove the pipe plug or o-ring plug from the top of the manifold tower.

2. Temporarily remove the filter bypass valve components from inside the manifold tower located just below the plug at the top of the manifold tower. Install the M1945AE expansion plug, and press it into the manifold until seated against the shoulder in the bore. Reinstall the filter bypass valve components and the plug that was removed from the top of the manifold tower.

3. Press the two M1035B dowel pins in the end of the primary shaft of the marine transmission, until 9 mm of the pin protrudes from the end of the primary shaft.

4. Assemble the M1904L piston ring into the groove of the 1017834 adapter, and install the adapter over the dowel pins in the shaft. Fasten the adapter to the shaft with two MA1062C capscrews (M12x70, Class 12.9) and torque the capscrews to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

5. Install the four MA1049B studs (M12x155) into the manifold. The shorter length of threads must be installed into the manifold.

6. Install a new A2916KD o-ring into the groove in the marine transmission manifold.

7. Install the power take-off assembly onto the manifold so that the drain slot in the PTO housing aligns with the drain hole in the manifold. Fasten with the four MA947B nuts and torque to 80 Nm (59 lb.ft).

8. Assemble the B1337D gasket, B3576C ditch plate, another B1337D gasket, and the XA7540B control valve assembly onto the manifold tower with four MA1052L capscrews (M10x45 class 12.9) and torque to a special reduced torque of 37 Nm (27 lb.ft) with threads lubricated. Install M2067Q protective caps into holes to prevent contamination.

9. Remove the protective plugs and install two MA1053K fittings (torque to 37 Nm or 27 lb-ft) into the power take-off housing. Install the elbow MA1053L (torque to 37 Nm or 27 lb-ft) at the top of the valve, and fitting M2483BR into the end of the ditch plate (torque to 16 Nm or 12 lb-ft). Attach the MA923AL hose (15 in.) from the front (transmission side) of the power take-off to the elbow at the top of the valve, and the MA923AP hose (17.6 in.) from the rear of the power take-off to the ditch plate fitting. Torque the hose ends to 16 Nm (12 lb-ft).

10. Attach and secure a customer supplied/fabricated support plate to the marine transmission support bracket or other acceptable area **before** securing to the power take-off.

⚠ CAUTION

The PTO housing must not be strained by the support plate when it is anchored. Any gap that remains between the surface of the support bracket and the PTO housing must be shimmed to reduce the gap to zero without straining the PTO housing.

11. Install and tighten four M12, class 8.8 capscrews through the support bracket into the power take-off and torque to 80 Nm (59 lb.ft). Following this procedure will prevent damaging deflection or strain when attaching the support plate.

12. The driven pump should now be installed, using a gasket that will seal on the pump mount face. Lube oil is supplied from the marine transmission to lubricate the pump spline, and then flows to the sump through the power take-off housing. Consequently, the pump face will be in contact with marine transmission oil, but not pressurized.

MG5301DC with Mechanical Transmission Control Valve

Refer to Figure 5.

1. Remove the cover from the rear of the marine transmission at the input shaft centerline. Remove and discard the o-ring.

2. Press the two M1035B dowel pins in the end of the primary shaft of the marine transmission, until 9 mm of the pin protrudes from the end of the primary shaft.

3. Assemble the M1904L piston ring into the groove of the 1017834 adapter, and install the adapter over the dowel pins in the shaft. Fasten the adapter to the shaft with two MA1062C capscrews (M12x70, Class 12.9) and torque the capscrews to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

4. Install the four MA1049B studs (M12x155) into the manifold. The shorter length of threads must be installed into the manifold.

5. Install a new A2916KD o-ring into the groove in the marine transmission manifold.

6. Install the power take-off assembly onto the manifold so that the drain slot in the PTO housing aligns with the drain hole in the manifold. Fasten with the four MA947B nuts and torque to 80 Nm (59 lb.ft).

7. Assemble the 1017974 gasket, 1017973 ditch plate, B3404 gasket, and the XA7108B control valve assembly onto the manifold tower with three MA996X (M12x120 class 10.9) and one MA996L (M12x70 class 10.9) capscrews and torque to 112 Nm (83 lb.ft) with threads lubricated.

8. Remove the protective plugs and install four MA1053K fittings (torque to 37 Nm or 27 lb-ft), two into the PTO housing, and two into the 1017973 ditch plate. Attach the MA923AL hose (hose A, 15 in.) from the front of the power take-off to the starboard side fitting on the 1017973 ditch plate, and the MA923AP hose (hose B, 17.6 in.) from the rear of the power take-off (near the pump mounting surface) to the other ditch plate fitting. Torque the hose ends to 16 Nm (12 lb-ft).

9. Attach and secure a customer supplied/fabricated support plate to the marine transmission support bracket or other acceptable area **before** securing to the power take-off.

⚠ CAUTION

The PTO housing must not be strained by the support plate when it is anchored. Any gap that remains between the surface of the support bracket and the PTO housing must be shimmed to reduce the gap to zero without straining the PTO housing.

10. Install and tighten four M12, class 8.8 capscrews through the support bracket into the power take-off and torque to 80 Nm (59 lb.ft). Following this procedure will prevent damaging deflection or strain when attaching the support plate.

11. The driven pump should now be installed, using a gasket that will seal on the pump mount face. Lube oil is supplied from the marine transmission to lubricate the pump spline, and then flows to the sump through the power take-off housing. Consequently, the pump face will be in contact with marine transmission oil, but not pressurized.

MG516, MG5170DC, MG5202DC, MG5205DC with Electric Control Valve with Mechanical Backup

Refer to Figure 7.

1. Remove the cover from rear of marine transmission at the input shaft centerline. Remove and discard the o-ring. Remove two o-ring plugs from the transmission manifold tower. Remove the pipe plug or o-ring plug from the top of the manifold tower.

2. Remove the filter bypass valve components. Install the M1945AE expansion plug, and press it into the manifold until seated against the shoulder in the bore. Reinstall the filter bypass valve components and the plug that was removed from the top of the manifold tower.

3. Press the two M1035B dowel pins in the end of the primary shaft of the marine transmission, until 9 mm of the pin protrudes from the end of the primary shaft.

4. Assemble the M1904L piston ring into the groove of the 1017834 adapter, and install the adapter over the dowel pins in the shaft. Fasten the adapter to the shaft with two MA1062C capscrews (M12x70, Class 12.9) and torque the capscrews to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

5. Install the four MA1049B studs (M12x155) into the manifold. The shorter length of threads must be installed into the manifold.

6. Install a new A2916KD o-ring into the groove in the marine transmission manifold.

7. Install the power take-off assembly onto the manifold so that the drain slot in the PTO housing aligns with the drain hole in the manifold. Fasten with the four MA947B nuts and torque to 80 Nm (59 lb.ft).

8. Assemble the 1018884 gasket, and 1018885 ditch plate onto the manifold tower, using four of MA1052C capscrews (M10x40 class 12.9), and torque to 75 Nm (55 lb.ft). Install the 1018594A gasket, and the 1017172F valve assembly onto the ditch plate with four MA1052J capscrews (M10x120class 12.9) and torque to a special reduced torque of 54 Nm (40 lb.ft) with threads lubricated.

9. Remove the protective plugs and install two MA1053K fittings (torque to 37 Nm or 27 lb-ft) into the power take-off housing. Install the elbow MA1053L (torque to 37 Nm or 27 lb-ft) at the top of the valve, and fitting M2483BR into the end of the ditch plate (torque to 16 Nm or 12 lb-ft). Attach one MA923AP hose (hose A, 17.6 in.) from front of the power take-off to the elbow at the top of the valve, and the other MA923AP hose (hose B, 17.6 in.) from the rear of the power take-off to the ditch plate fitting. Torque the hose ends to 16 Nm (12 lb-ft).

10. Attach and secure a customer supplied/fabricated support plate to the marine transmission support bracket or other acceptable area **before** securing to the power take-off.

⚠ CAUTION

The PTO housing must not be strained by the support plate when it is anchored. Any gap that remains between the surface of the support bracket and the PTO housing must be shimmed to reduce the gap to zero without straining the PTO housing.

11. Install and tighten four M12, class 8.8 capscrews through the support bracket into the power take-off and torque to 80 Nm (59 lb.ft). Following this procedure will prevent damaging deflection or strain when attaching the support plate.

12. The driven pump should now be installed, using a gasket that will seal on the pump mount face. Lube oil is supplied from the marine transmission to lubricate the pump spline, and then flows to the sump through the power take-off housing. Consequently, the pump face will be in contact with marine transmission oil, but not pressurized.

MG5301DC, MG6650-00-SC, MG6848-00-SC with Electric Control Valve

Refer to figure 9.

1. Remove the cover from the rear of the marine transmission at the input shaft centerline. Remove and discard the o-ring.

2. Remove the existing transmission control valve, ditch plate and gasket from the manifold. Discard the ditch plate and gasket.

3. Assemble the B3404 gasket, and the 1018482 ditch plate onto the manifold using two MA1062P capscrews (M12x130 class 12.9), and torque to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

4. Install the 1018481 gasket, 10189874 ditch plate, 1018886 gasket and 1018480 ditch plate, using two MA1062R capscrews (M12x70 class 12.9) and five MA1062Q capscrews (M12x45 class 12.9) and torque to 130 Nm (96 lb.ft).

5. Reassemble the transmission control valve using gasket 1017569 and four existing MA1052P capscrews (M10x150class 12.9) and torque to a special reduced torque of 54 Nm (40 lb.ft) with threads lubricated. Be sure to install a new 1017136B gasket between the two halves of the transmission control valve assembly.

6. Press the two M1035B dowel pins in the end of the primary shaft of the marine transmission, until 9 mm of the pin protrudes from the end of the primary shaft.

7. Assemble the M1904L piston ring into the groove of the 1017834 adapter, and install the adapter over the dowel pins in the shaft. Fasten the adapter to the shaft with two MA1062R capscrews (M12x70, Class 12.9) and torque the capscrews to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

8. Install the four MA1049B studs (M12x155) into the manifold. The shorter length of threads must be installed into the manifold.

9. Install a new A2916KD o-ring into the groove in the marine transmission manifold.

10. Install the power take-off assembly onto the manifold so that the drain slot in the PTO housing aligns with the drain hole in the manifold. Fasten with the four MA947B nuts and torque to 80 Nm (59 lb.ft).

11. Assemble the 1017974 gasket, and 1018914 ditch plate onto the manifold tower, using four MA1062Q capscrews (M12x45 class 12.9), and torque to 130 Nm (96 lb.ft). Install the 1018594A gasket, and the 1017172K valve assembly onto the ditch plate with four MA1052J capscrews (M10x120class 12.9) and torque to a special reduced torque of 54 Nm (40 lb.ft) with the threads lubricated.

12. Remove the protective plugs and install two MA1053K fittings (torque to 37 Nm or 27 lb-ft), one into power take-off housing at the rear location, and one into ditch plate at the rear location. Install two MA1053L elbows (torque to 37 Nm or 27 lb-ft), one into power take-off housing at the front location, and one into the ditch plate at the starboard side location. Attach the MA923AL hose (15 in.) from the elbow at the front of the power take-off to the elbow at the right of the ditch plate, and the MA923AP hose (17.6 in.) from the rear of the power take-off to the fitting at the rear of the ditch plate. Torque the hose ends to 16 Nm (12 lb-ft).

13. Attach and secure a customer supplied/fabricated support plate to the marine transmission support bracket or other acceptable area before securing to the power take-off.

⚠ CAUTION

The PTO housing must not be strained by the support plate when it is anchored. Any gap that remains between the surface of the support bracket and the PTO housing must be shimmed to reduce the gap to zero without straining the PTO housing.

14. Install and tighten four M12, class 8.8 capscrews through the support bracket into the power take-off and torque to 80 Nm (59 lb.ft). Following this procedure will prevent damaging deflection or strain when attaching the support plate.

15. The driven pump should now be installed, using a gasket that will seal on the pump mount face. Lube oil is supplied from the marine transmission to lubricate the pump spline, and then flows to the sump through the power take-off housing. Consequently, the pump face will be in contact with marine transmission oil, but not pressurized.

Adjustments Prior to Operation

The only mechanical adjustment necessary is to confirm that the linkage of the engaging mechanism allows correct travel of the power take-off valve lever as shown in the respective installation figures. The valve lever should be in its detent position at full travel of the control lever. The power take-off clutch actuation pressure can be adjusted by adding or removing shims from the power take-off control valve as shown on the illustrations of the appropriate control valve. If the transmission control valve was disturbed, confirm that the linkage of the engaging mechanism allows correct travel of the marine transmissioin control valve lever.

Live Power Take-off

The installation dimensions for the live power take-off are the same for all transmission models, and are shown in Figure 11. The parts for the live power take-off assembly are also the same for all transmission models, and are also shown in Figure 11. Mounting arrangements do vary, depending on the marine transmission model. Additional installation parts may be necessary, depending on the transmission model, and are identified in figures that are referred to in the following paragraphs. Note that the part numbers shown are for reference only, and a current bill of material should be used to order the proper parts.

All MG516, MG5170DC, MG5202DC, MG5205DC, and MG5301DC with Manual Control Valve Only

Refer to Figure 11.

1. Remove the cover from the rear of the marine transmission at the input shaft centerline. Remove and discard the o-ring.

2. Press the two M1035B dowel pins in the end of the primary shaft of the marine transmission, until 9 mm of the pin protrudes from the end of the primary shaft.

3. Assemble the M1904L piston ring into the groove of the 1017834 adapter, and install the adapter over the dowel pins in the shaft. Fasten the adapter to the shaft with two MA1062R capscrews (M12x70, Class 12.9) and torque the capscrews to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

4. Install a new A2916KD o-ring into the groove in the marine transmission manifold.

5. Install the 1015532 carrier onto the manifold so that the drain slot in the carrier bore aligns with the drain hole in the manifold. Fasten with four MA1062S capscrews (M12x90, Class 12.9) and torque to 130 Nm (96 lb.ft).

6. Assemble the internal snap ring into the splined adapter (A2669DG snap ring with 1017835 adapter for SAE No. 32-4 spline, and A2669FV snap ring with 1017836 adapter for SAE No. 38-4 spline) and install it over the drive adapter.

7. The driven pump should now be installed, using a gasket that will seal on the pump mount face. Lube oil is supplied from the marine transmission to lubricate the pump spline, and then flows to the sump through the power take-off housing. Consequently, the pump face will be in contact with marine transmission oil, but not pressurized.

8. Note that when using a 4 bolt pump, the four MA1062S capscrews from step 5 above must be replaced with studs of adequate length to mount both the pump and the carrier. The studs should be screwed into the manifold a minimum of 18 mm. Secure the pump and carrier with nuts, and torque to the appropriate value as shown in the bolt torque chart in the Description and Specification section. Be sure that a gasket is installed between the pump face and its mounting surface.

MG5301DC, MG6650-00-SC, MG6848-00-SC with Electric Control Valve

Refer to Figure 12.

Note: The installation of a live power take-off on these transmissions requires the relocation of the control valve.

1. Remove the cover from the rear of the marine transmission at the input shaft centerline. Remove and discard the o-ring.

2. Remove the existing control valve, ditch plate and gasket from the manifold. Discard the ditch plate and gasket.

3. Assemble the the B3404 gasket, and 1018482 ditch plate onto the manifold using two MA1062P capscrews (M12x130 class 12.9), and torque to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

4. Install the 1018481 gasket, 1018874 ditch plate, 1018886 gasket and 1018480 ditch plate, using two of MA1062R capscrews (M12x70 class 12.9) and five of MA1062Q capscrews (M12x45 class 12.9) and torque to 130 Nm (96 lb.ft).

5. Reassemble the transmission control valve using gasket 1017569 and four existing MA1052P capscrews (M10x150class 12.9) and torque to a special reduced torque of 54 Nm (40 lb.ft) with threads lubricated. Be sure to install a new 1017136B gasket between the two halves of the transmission control valve assembly.

6. Press the two M1035B dowel pins in the end of the primary shaft of the marine transmission, until 9 mm of the pin protrudes from the end of the primary shaft.

7. Assemble the M1904L piston ring into the groove of the 1017834 adapter, and install the adapter over the dowel pins in the shaft. Fasten the adapter to the shaft with two MA1062R capscrews (M12x70, Class 12.9) and torque the capscrews to 130 Nm (96 lb.ft). Note that all threaded fasteners should be lightly lubricated prior to assembly.

8. Install a new A2916KD o-ring into the groove in the marine transmission manifold.

9. Install the 1015532 carrier onto the manifold so that the drain slot in the carrier bore aligns with the drain hole in the manifold. Fasten with four MA1062S capscrews (M12x90, Class 12.9) and torque to 130 Nm (96 lb.ft).

10. Assemble the internal snap ring into the splined adapter (A2669DG snap ring with 1017835 adapter for SAE No. 32-4 spline, and A2669FV snap ring with 1017836 adapter for SAE No. 38-4 spline) and install it over the drive adapter.

11. The driven pump should now be installed, using a gasket that will seal on the pump mount face. Lube oil is supplied from the marine transmission to lubricate the pump spline, and then flows to the sump through the power take-off housing. Consequently, the pump face will be in contact with marine transmission oil, but not pressurized.

12. Note that when using a 4 bolt pump, the four MA1062S capscrews from step 5 above must be replaced with studs of adequate length to mount both the pump and the carrier. The studs should be threaded into the manifold for a depth of 18mm on units with an iron manifold, and 24 mm on units with an aluminum alloy manifold. Secure the pump and carrier with nuts, and torque to the appropriate value as shown in the bolt torque chart in the Description and Specification section. Be sure that a gasket is installed between the pump face and its mounting surface.

#1020075 03/01

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